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INTEGRATED WATER MANAGEMENT DISTRICT

Report No. 49
Main Document

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Water Policy Program
International Resources Group Winrock International Nile Consultants

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INTEGRATED WATER MANAGEMENT DISTRICT

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Executive Summary

Introduction

The purpose of this report is to present the results of Benchmark C.1 of the Memorandum of Understanding between the Government of the Arab Republic of Egypt (GOE) and USAID/Egypt for the Agricultural Policy Reform Program (APRP) Tranche V (FY 01/02). The benchmark states:

> *The GOE (MWRI) will adopt a policy to integrate all water management functions at the district level to support decentralized management.*

The verification indicators to measure success are:

1. *MWRI will approve a policy to integrate all water management functions at the district level.*
2. *MWRI will designate two pilot districts and initiate activities in these districts to show how the policy is to be implemented.*

This report documents the success of the ministry in establishing two pilot districts for integrated water management and approving a policy to integrate all water management functions at the district level.

Background

In recent years, a global understanding has developed that water management is best served through an integrated package of services and practices, including irrigation, drainage, conjunctive water utilization, rainfall management and flood control. It is also widely accepted that water management policies can be made more effective by directing the level of operation to localized coordination entities. The MWRI has a long-term goal to reorganize its internal functions and operations through a process of local consolidation and ministry-wide decentralization, including devolution of authority to the local level.

Under present operational and administrative conditions, the management of supplies and services within the MWRI is handled through line department directives and functions emanating from the central ministry to lower line offices at the inspectorate and district levels. Usually there is limited coordination or communication in the planning and delivery of services and supplies, or consolidation and sharing of resources, at these levels. As a result, the District Engineer focuses solely on irrigation issues, and has little or no management coordination authority to integrate the other aspects of delivery and use, *i.e.*, drainage, groundwater and rainfall.

The objectives of this policy reform are to move toward the goal of reorganization of the MWRI internal functions and operations including devolution of authority to the local level thereby decentralizing water management and eliminating district-level inefficiencies and redundancies.

This report focuses on the achievements leading to the national policy to integrate all water management functions at the district level.

Achievements

There have been several achievements of the IWMD benchmark that are noteworthy:

1. The concept of exactly what an IWMD should be was developed from intensive discussions with MWRI staff at different levels (central, governorate, and district) as well as reviewing previous studies and documents concerning an "integrated" or "ideal" district for water management within the MWRI.
2. Criteria for selecting the pilot districts were developed and approved by the MWRI leaders.
3. Two pilot areas were selected from the seven proposed districts. Each pilot district includes all MWRI activities and obtains water from the multiple sources: Nile system canal water, drainage system water, and groundwater.
4. Detailed assessment of conditions and practices in each pilot district was conducted and the IWMD policy was outlined.
5. Activities were initiated in both pilot districts to show how the IWMD policy is to be implemented.
6. Modification of irrigation and drainage districts boundaries was made as the first step of implementation of the policy.
7. The Arabic name:
   ? ???? ???????O?????????
   was selected for use throughout Egypt to replace IWMD.
8. An organizational plan, including an organization chart, position descriptions, definitions of roles and responsibilities, resources required, and proposed timeline for implementing the IWMD national policy was developed and discussed in seminars and a stakeholder workshop. The result was the finalized institutional plan contained in this report and recommended to MWRI management.
9. A water monitoring plan was developed for implementation with the objective of ensuring that the IWMDs have the ability to integrate the various supply sources in a rational manner consistent with most effective use of Egypt's total water resources.
10. Formal training courses were conducted in the two pilot districts and directorates involving 26 participants and a total of 102 participant days.
11. The MWRI policy committee approved the IWMD national policy on 4 December 2001.
12. The ministerial decree was issued establishing the IWMD national policy effective 10 December 2001.

Recommendations

The IWMD benchmark working group recommends that the MWRI:

1. Implement the organization of the IWMD in a stepped (or phased) process.
2. Provide the necessary personnel and equipment to each newly established IWMD district.
3. Direct the Mechanical and Electrical Department at the district level to operate and maintain the central pump stations. Operation and maintenance of district pumps such as groundwater pumps, branch canal pumps, and intermediate drainage reuse pumps should be the responsibility of the IWMD. This recommendation may involve transferring some M&E staff to the IWMD district.

4. Clearly define decisions that are to be made by the IWMD locally (decentralized). The IWMD must have the authority to make these decisions and the responsibility for consequences of their decisions.
5. Assign a separate annual budget for the IWMD to conduct its operation and maintenance plans.
6. Establish a water monitoring program for both quantity and quality of canals, drains, and groundwater within each newly formed IWMD. Provide suitable measurement equipment to the district and assist the district to establish a link with a regional or central laboratory for quality measurements of water samples.
7. Provide suitable training for different positions in the IWMD.

1 Introduction

1.1 Overview

The Agricultural Policy Reform Program (APRP) is a United States Agency for International Development (USAID) grant program involving several ministries. The Ministry of Agriculture and Land Reclamation (MALR) is the primary Egyptian governmental agency charged with support of agricultural production. The Ministry of Water Resources and Irrigation (MWRI) has the prime management responsibility for Egypt's water resources. The MALR, MWRI and USAID, under the umbrella of the APRP, jointly designed an agricultural and water policy package, which consists of integrated policy and institutional reforms. USAID supports the ministries' efforts through annual cash transfers based on performance in achieving identified and agreed-upon policy reform benchmarks and technical assistance.

Technical assistance for the water policy analysis activity is provided through a task order (Contract PCE-I-00-96-00002-00, Task Order 807) under the umbrella of the Environmental Policy and Institutional Strengthening Indefinite Quantity Contract (EPIQ) between USAID and a consortium headed by the International Resources Group (IRG) and Winrock International. Local technical assistance and administrative support is provided through a subcontract with Nile Consultants.

1.2 Purpose of the Report

This report documents the activities of MWRI under the Tranche V, C.1 Benchmark, which states:

> ***The GOE (MWRI) will adopt a policy to integrate all water management functions at the district level to support decentralized management.***

Satisfactory achievement of the BM requires the accomplishment of two verification indicators:

1. MWRI will approve a policy to integrate all water management functions at the district level.
2. MWRI will designate two pilot districts and initiate activities in these districts to show how the policy is to be implemented.

1.3 Background

In recent years, a global understanding has developed that water management is best served through an integrated package of services and practices, including irrigation, drainage, conjunctive water utilization, rainfall management and flood control. It is also widely accepted that water management policies can be made more effective by directing the level of operation to localized coordination entities. The objective of this benchmark is to initiate such a program in Egypt by decentralizing water management and focusing on integrated district-level coordination and management.

Decentralized management is not a new concept for the water resources sector in Egypt. A study during the 1990s conducted by the office of the Minister recognized the "model irrigation district" as a means of testing decentralized management and authority at the local level, and consolidating operations and management of water resources at the district level. In addition, participation of the water users has been at the center of a movement leading toward increased local private sector water management. The Irrigation Improvement Project, started by USAID in 1989, established a pattern of tertiary-level system transfer to water users. More recently, policy reforms under the APRP program are leading toward private sector involvement in secondary level system O&M through Branch Canal Water User Associations. The associations allow for initiation of other donor-assisted projects in this area. Most recently, also under APRP sponsorship, a policy reform and pilot program in irrigation management transfer to water users and the private sector was undertaken. These are all efforts in privatization and are leading toward progressive decentralization and localized management of water resources that are expected to increase agricultural production per unit of Nile system water.

Despite the progress noted above, the concept of district level integrated water management has yet to be introduced in Egypt, although it is now a major feature in many other countries. These countries, among the most successful examples being Mexico, USA, France, Spain, and the Netherlands, have demonstrated satisfactory experience in using this means of local water management. The MWRI has a long-term goal to reorganize its internal functions and operations through a process of local consolidation and ministry-wide decentralization, including devolution of authority to the local level. This benchmark supports this goal and its successful implementation will mark a major turning point for the decentralization process to be introduced in Egypt.

Under present operational and administrative conditions, the management of supplies and services within the MWRI is handled through line department directives and functions emanating from the central ministry to lower line offices at the inspectorate and district levels. Usually there is limited coordination or communication in the planning and delivery of services and supplies, or consolidation and sharing of resources, at these levels. As a result, the District Engineer focuses solely on irrigation issues, and has little or no management coordination authority to integrate the other aspects of delivery and use, i.e., drainage, groundwater and rainfall. The impetus for this policy reform, therefore, is to: (a) develop a strategy and procedure for decentralizing services and delivery, (b) improve and focus district level operations to remove costly inefficiencies and redundancies, and (c) provide greater flexibility and control to technical service providers and cultivators at the district level.

The objectives of this policy reform are to move toward the goal of reorganization of the MWRI internal functions and operations including devolution of authority to the local level thereby decentralizing water management and eliminating district-level inefficiencies and redundancies.

The specific objectives of this benchmark are to:

- Enable the MWRI to make the most efficient use of water from all sources.
- Integrate all sources of water into district-level management decisions thereby increasing production per unit of Nile system water.
- Allow timely adjustments of water deliveries to and within the districts.

- Determine if the existing legal framework governing water and water management allows for all administrative and operational reforms encompassed by this benchmark.

1.4 Organization of the Report

This report consists of six chapters plus five appendices printed as two volumes – the first containing the main document plus Appendix A and the second containing Appendices A – E. Chapter 1 is an introduction giving the benchmark statement, verification indicators, and background plus the purpose and organization of the report. Chapter 2 describes the selection of the pilot districts and briefly describes the two pilot Integrated Water Management Districts. Chapter 3 discusses activities in the pilot districts. Chapter 4 deals with the organizational structure proposed for the IWMDs. Chapter 5 gives the approved national policy in Arabic together with an English language translation. Chapter 6 gives recommendations of the IWMD working group for implementation of the national policy.

2 The Pilot Districts

2.1 Introduction

The district is the smallest unit of the MWRI hierarchy responsible for all operational management aspects within its domain. The district office is a governmental office similar to other localities that exists in the administrative district called "Markaz". However the boundaries of MWRI district is usually different than the Markaz where the MWRI district is determined by the hydraulic characteristics of the irrigation and drainage network. Therefore, the MWRI district may overlap with more than one Markaz, and the Markaz may overlap with more than one MWRI district.

Due to the different activities conducted by the MWRI at the district level, such as irrigation activities, drainage activities, groundwater activities, *etc*., the MWRI had established separate specific entities for these activities. Usually there are two MWRI districts – an irrigation district and a drainage district. However, in some districts, a groundwater district and a mechanical and electrical district exist to take care of groundwater utilization and operation and maintenance of the pump stations, respectively. Although all these districts are MWRI units, they have different boundaries. One purpose of an IWMD is to integrate all these various activities into a single district so as to facilitate efficient operation of the system and management of the water resources.

Recently, the MWRI launched national and pilot programs to improve irrigation management in Egypt. One of these programs is the Irrigation Improvement Project (IIP); another is the Water Boards program. The MWRI has plans to establish certain units to work closely with the district staff. These innovations impacted the selection of the pilot areas for the IWMD benchmark.

2.2 Selection of Pilot Districts

The IWMD benchmark team made several visits to some irrigation districts nominated for consideration as pilot districts in upper and lower Egypt. Also, the team had several meetings with MWRI staff at different levels (undersecretary, general director, inspector and district engineer) in all MWRI activity areas, *e.g.* irrigation, drainage, mechanical and electrical O&M, groundwater, *etc*. Several meetings and detailed discussions were held by the IWMD core working-group that included the heads of the irrigation department and the drainage authority in order to set and agree on the criteria for selecting the two pilot districts.

2.2.1 Criteria

The selection criteria were developed to consider most of the MWRI activities at the district level. It was important to include districts practicing and/or planning for groundwater use and drainage water reuse. In order to facilitate the work of the IWMD, it was proposed also to select districts with maximum correspondence of irrigation and drainage boundaries, *i.e.*, so that the irrigation district and the drainage district covered the same area. The list of the selection criteria were as follows:

1. A pilot area should have a distinct boundary.
2. A pilot district should contain only one drainage district if possible.

3. The boundary of the drainage district should coincide as closely as possible with the pilot irrigation district boundary.
4. The inflow-outflow points of a pilot district should be few and easily monitored.
5. Use of non-conventional water resources (*e.g*., groundwater or drainage water) should be widely practiced in a pilot district
6. If the district is not already using non-conventional water resources, a pilot district should have a high potential for development of such resources.
7. A pilot district should contain IIP components as well as functioning WUAs.
8. An IWM pilot district should have already implemented MISD activities.
9. The pilot district should contain at least one Water Board.
10. Well-trained staff should exist in sufficient numbers in both districts (irrigation and drainage).
11. There should already be fairly good cooperation between the district irrigation engineer and drainage engineer.
12. The two pilot districts should be of size reasonably typical of the irrigation districts served by the Nile system.

2.2.2 Procedure

In order to select two pilot districts that meet the mentioned criteria, the working group had intensive consultations and meetings with MWRI staff at different levels (central, governorate, and district). There were seven districts proposed or nominated for consideration as an IWMD pilot. Some data and information for these districts are shown in Table 2-1. These results were discussed within the IWMD core working-group that included the heads of the MWRI Irrigation Department and Egyptian Public Authority for Drainage Projects.

2.2.3 Districts Selected

Based on the criteria, the two pilot districts were selected for the IWMD benchmark. One of them has water board pilot program. Both districts are in lower Egypt (Nile Delta region). The two pilot districts are:

1. South Zifta Irrigation District in the Menoufia Irrigation Directorate.
2. Ibrahimia Irrigation District in the West Sharkia Directorate.

2.3 Brief Description of Pilot Districts

2.3.1 South Zifta District

2.3.1.1 Irrigation District

South Zifta irrigation district is one of 3 districts that constitute the Zifta inspectorate. The Zifta inspectorate is one of 3 inspectorates included in the Menoufia irrigation directorate. The current command area of the South Zifta irrigation district is 42360 feddans. The district receives its water quota from three canals: El-Sahel, El-Atf and Elkhadrawia. These canals branch from the Menoufi Rayah through a main canal called the Mit Berah canal as shown in Appendix B, Figure B-1. The South Zifta district shares the water of the three canals with two other districts: Quesna (55110 feddans) and Beket Elsabaa (39490 feddans). The water quota for the South Zifta irrigation district is measured at three reference points: the Shobra

Table 2-1. Districts nominated for consideration as IWMD pilot districts.

Item	1. Abou Kebir District	2. Fakous District	3. Wasta District	4. South Zifta District	5. Shebin Elqanater District	6. Hehia	7. Ibrahimia
1. Irrigation Directorate	West Sharkia	Salhia	Beni Suef	Menoufia	Qalubia	East Sharkia	West Sharkia
2. Area (feddans)	48,000	74,000	36,320	42,360	52,888	45250	59214
3. irrigation &drainage Boundaries	Coincidence about 95%	Coincidence about 100%	Coincidence about 80%	Coincidence about 70%	Coincidence about 50%	Coincidence large	Coincidence about 90%
4. Water inflow points	Few (one major & four minors)	Few (two)	Few (two)	Few (three)	Few (one)	Few (two)	Few (two canals + Direct irrig)
5. non-conventional water resources (currently used)	3 reuse p.s	9 reuse p.s.	·One GW well ·5 reuse p.s.	· 9 existing GW wells ·21 GW wells under construction.	·3 wells under construction		·10 wells under construction ·2 reuse p.s under construction
6. non-conventional water resources (future use)	Possible (GW)	Need to be studied	possible	possible	possible		possible
7. IIP & WUAs	No	·3000 fed covered ·6500 fed under imp. ·the rest of area is under study	·8000 fed. covered	No	No	No	No
8. MISD	Yes	No	Under expansion	No	No	No	Under MISD expansion
9. Cooperation between Drainage and Irrgation Engineers	good	good	good (even at directorate level)	good	good	good	good
10. Trained staff	good	good	Not mentioned	good	They need training	good	good
11. Water Boards	No	No	No	No	No	Yes	Yes

Note:
All districts practicing groundwater through individual wells in addition to the governmental wells mentioned in the table
IWMD: Integrated Water Management District
MISD: Matching Irrigation Supplies and Demands benchmark

Bekhoum Regulator at km 16.450 on the Elsahel canal, the Begeiram regulator on the Elkhadrawia canal at km 16.660 and the Kafr Nafra regulator on the El-Atf canal at km 34.000. The South Zifta district is the end district of Zifta inspectorate. Therefore, a water deficit is experienced many times. The surplus of the canal water is diverted to a unique drainage network that runs parallel to the irrigation network.

In addition to canal water, the district is using groundwater from nine wells scattered throughout the district. The wells are mainly located at the canal ends in order to compensate for insufficient canal flow. Farmers have dug their own wells in their fields for use in cases of water shortage. It was found that many farmer wells exist in the South Zifta district and most of them are illegal, *i.e.*, without proper permits.

2.3.1.2 Drainage District

The Zifta drainage district is 31871 feddans and is responsible for maintaining the open drains and tile drains system. The area is totally covered with a tile drainage system and divided into five sub-regions. The area of the sub-regions ranges from nearly 3300 feddans to 8200 feddans. The boundary of the drainage district is different than that of the irrigation district. The coincidence of boundaries is estimated as 70%.

There are four main open drains in the district as shown in Appendix B, Figure B-3. These drains are the Masgad Wasif drain, the Elkhadrawia drain, the Mastay drain and the Kala Elbab drain. All these drains collect drainage water of branch drains and tile drains and spill into a major drain called the Dahtoura drain. The Dahtoura drain runs parallel to the Rayah Elabbasi and then underneath the Rayah to spill into the Zifta drain. At the end of the Dahtoura drain there is a relatively large pump station to divert most of drainage water of the Dahtoura drain into the Abbasi Rayah to be mixed with its water.

2.3.1.3 Groundwater District

Zifta Groundwater District is a unit of the Mechanical and Electrical Department of the MWRI. The district is mainly responsible for operation and maintenance of the well pumps. The area of the district includes 13 wells of which, nine are in the South Zifta irrigation district. The design discharge of each well is about 1000 m^3/hour. However, the existing discharge of each well has declined to be about 500 m^3/hour on the average. The average depth of the groundwater wells is about 10 m and district engineers consider the water as deep groundwater compared to farmer wells. Operation of the wells is according to the request of the irrigation district engineer as he determines when and how long to operate each well.

2.3.2 Ibrahimia District

2.3.2.1 Irrigation District

The Ibrahimia irrigation district is one of two irrigation districts that constitute the Zagazig inspectorate. The Zagazig inspectorate is one of two inspectorates in the West Sharkia irrigation directorate. The current command area of the Ibrahimia irrigation district is 59000 feddans. The district receives its water quota from the Bahr Muis canal from km 36.000 to km 56.000 on the left side.

In addition to canal water, the district is proposing use of groundwater through 10 wells scattered throughout the district. The wells are mainly located at the canal ends in order to compensate for insufficient canal flow. Farmers have dug their own wells in their fields for use in cases of water shortage. It was found that many farmer wells exist in the Ibrahimia district and most of them are illegal, *i.e.*, without proper permits.

2.3.2.2 Drainage District

There are two drainage districts in Ibrahimia overlapping with the irrigation district: the East Ibrahimia and the West Ibrahimia drainage districts. The area of the East Ibrahimia district is 41100 feddans and that of West Ibrahimia is 37500 feddans. The two district offices are in one building close to the Ibrahimia irrigation district building. The drainage districts are responsible for maintaining the open drains and tile drains system. The area is totally covered with a tile drainage system and divided into five sub-regions. The area of the sub-regions ranges from nearly 3300 feddans to 8200 feddans. The boundaries of the two drainage districts do not coincide with irrigation district boundaries. The coincidence of boundaries is estimated as 70%.

There are two main open drains in the district as shown in Appendix C, Figure C-3. These drains are the Akwa and Bahr Saft drains. All the drains collect drainage water of branch drains and tile drains and spill into these two main drains. Drainage water of these drains is reused in the downstream parts of the irrigation system outside of the district.

2.3.2.3 Groundwater District

It is proposed to construct ten wells in the district to compensate for insufficient canal flow at the tail ends. The irrigation district (not the Mechanical and Electrical department) plans to operate these wells. Therefore, there is no groundwater district similar to that in Zifta.

2.3.2.4 Water Boards

The water boards in Ibrahimia are part of a pilot program aimed at establishing boards of water user representatives from different villages. The water boards are expected to participate in water management at the district level. The legal framework was not yet developed during the period of activity on the IWMD benchmark. However, there were some meetings being conducted at the district to get the water boards acquainted with their tasks. Only two pilot canals are being considered for water boards in the Ibrahimia district.

3 Pilot District Activities

This chapter describes the IWMD activities in the two pilot integrated water management districts: South Zifta and Ibrahimia. .

3.1 Understanding the MWRI Structure at the District Level

Several meetings were held at the directorate and district levels in addition to seminars and workshops. The purpose of theses meetings was to expand the understanding of the MWRI structure in the district, including the roles and responsibilities of units and personnel.

3.2 Evaluation of Current Responsibilities and Mandates

3.2.1 Overlap of Boundaries

Detailed evaluation of information regarding each of the districts revealed that the irrigation and drainage district boundaries do not coincide. This lack of agreement of district boundaries will likely be a major constraint in establishing an IWMD. The groundwater district boundaries were also found to differ from irrigation and drainage district boundaries. For a properly constituted IWMD, it is important that the new district officer has responsibility and authority to manage all water resources within the new district. Hence, the boundaries especially for irrigation and drainage activities must agree as closely as possible under the IWMD approach. Adjustments of boundaries must be an integral part of the process of forming IWMDs as the policy is implemented nationwide so that overlaps between different IWMDs are minimized.

3.2.2 Organization, Staff and Responsibilities

The current organization of the irrigation district, drainage district and groundwater district has been reviewed and evaluated. In Appendix B, Figure B-5, and Appendix C, Figures C-5 and C-6, show examples of the structure of these districts. It is noted that one civil engineer heads each district (irrigation or drainage) and is responsible for all operation and maintenance activities within the district. The district is divided into small entities each of which is headed by a technician who has a certificate of a technical school. The technician has some assistants to help him carry out the entity tasks. Irrigation and drainage districts have nearly the same staff and roles as listed in the following:

3.2.2.1 Irrigation District and Drainage District

3.2.2.1.1 Administration Section

This section is currently responsible for completing the procedures of the permit of irrigation issues such as permission for establishing an irrigation opening from the canal. The section is also responsible for salary distribution.

3.2.2.1.2 Encroachment Section

This section is responsible for completing and following up the procedures of reporting and removing encroachments along the canal systems. This may include transgression on canal

banks, dumping wastes into canals, *etc*. It is responsible for editing and redaction of encroachment reports according to Law 48 and Law 12.

3.2.2.1.3 Complaints Section

This section is responsible for receiving beneficiary's complaints and preparing the reply to them.

3.2.2.1.4 Personnel Section

This section is responsible for personnel affairs such as working hours, vacations, preparing salary time sheets.

3.2.2.1.5 Legal Affairs Section

This section is responsible for legal procedures of work issues for personnel and also for collecting fines from violators.

3.2.2.1.6 Contractors Section

This section is responsible for assisting the district engineers in preparing the technical data of canals such as levels, cross sections, drawings, *etc*.

3.2.2.1.7 Book-keeping (Archiving) Section

This section is responsible for receiving and sending mails.

3.2.2.1.8 Telephone Operators

The telephone operators section is very important as it receives all messages concerning water management at the district such as adjusting water levels, canal rotation, water allocation problems, *etc*. So they work day and night continuously.

3.2.2.1.9 Gatekeepers

Gatekeepers are responsible for opening the canal gates to maintain the required water levels upstream and downstream of the gate as ordered by the district engineer.

3.2.2.1.10 Maintenance Crew

The maintenance crew is responsible of cleaning canals (manually or with small weed-cutting machines) and removing any obstacles that hamper the water flow. For the drainage district, the crew is also responsible for maintaining and cleaning the tile drains.

3.2.2.2 Groundwater District

The groundwater district is different than the irrigation and drainage districts. This district belongs to the Mechanical & Electrical Department. Therefore, it is headed by a mechanical engineer. At Zifta, the groundwater district has nine mechanical engineers in addition to a number of technicians. The district is responsible for operation and maintenance of the

groundwater pumps based on instructions of the irrigation engineer. The groundwater district has its own organization regarding administrative and personnel aspects.

3.2.2.3 Irrigation Inspectorate

The irrigation district is supervised by an irrigation inspectorate. The irrigation inspectorate of Zifta is shown in Figure B-6, in Appendix B. The Zifta inspectorate includes three irrigation districts. The Menoufia irrigation directorate consists of three inspectorates as shown in Figure B-7, in Appendix B.

3.2.3 Equipment and Buildings

The irrigation districts are lacking maintenance equipment as most of the maintenance work is done by the private sector under contract with the General Directorate. The district has small equipment for manual cleaning of canals. The drainage district has one each of washing machine, tractor, and manual weed-cutting machine.

There is one building for the Zifta inspectorate, South Zifta irrigation district, Zifta drainage district, and groundwater district. The building is old and not well furnished. In Ibrahimia, the buildings look good enough because there are separate buildings – one for irrigation and two for drainage. These buildings could be reorganized to better serve the IWMD.

3.2.4 Existing Water Management and Monitoring

The irrigation district engineer is not involved in preparing the water distribution plan. The General Director of the directorate prepares this plan. The irrigation district engineer is responsible to distribute the water within his/her district for the branch canals according to the canal rotation table set by the General Director. The district engineer adjusts water levels in the canals to meet the farmer demands. In case of water shortage, he asks the General Director to provide him additional water. There is no routine measurement of canal discharges.

Gatekeepers are responsible for opening the gates to maintain the required water levels. They also report the water levels three times (two times in some districts) a day to the district engineer at 6.00 a.m., 2.00 p.m., and 6.00 p.m. Water levels are measured using a marble gauge upstream and down stream of the gate. The end of the canal also has a marble gauge to measure water level. The telemetry system is used to measure water levels upstream and downstream of the main gates – particularly those separating districts, inspectorates, and directorates. However, the district engineer has no direct access to such data as the telemetry system is operated by the General Director.

The drainage water levels are recorded through reading the marble gauge at the start and outfall of each drain.

There is no regular monitoring of groundwater – quality, quantity pumped, and piezometric levels are not measured at the production wells or elsewhere in the aquifer.

3.2.5 Financial and Funding Issues

There is no specific budget for district. All financial aspects and issues are managed through the General Director.

3.2.6 Decision-Making Process

In most decisions, the district engineer must refer to the general director. Regarding operation of canals, the district engineer is not involved in the determination of canal water requirements and scheduling of water releases (the annual water allocation plan). However, the district engineer may have the right to change the canal rotation within his/her district (small branch canals) to solve some water allocation problems but he/she must inform the general director. Regarding canal maintenance, the district engineer determines the maintenance requirements such as dredging, removal of aquatic weeds, rehabilitation of structures, *etc.* Then she/he tabulates and prioritorizes these requirements and sends them to the general director who in turn determines the district maintenance plan.

3.3 Training

In order to improve the performance of the district, a computer database should be developed. The pilot districts were found lacking of needed computers and training. Therefore, EPIQ provided a computer to the district and established training courses for the district staff including the irrigation engineer, drainage engineer, and technicians. The training included basic computer operation, use of spreadsheets for data processing including data entry, data analysis, and performing calculations. The computer training included also instructing district/directorate staff on use of email including sending, receiving, and managing attachments. The email system enabled the district to be in direct contact with the directorate and hence receive the telemetry data.

3.4 Water Monitoring

None of the existing districts have intensive water monitoring programs. In order for an IWMD to function most effectively, the new district should have a comprehensive monitoring plan covering all the various sources of supply. This plan and resulting monitoring program should include both quantity and quality of water. To develop this plan, the EPIQ team hired a water-monitoring specialist on a TDY assignment. The complete report of this effort is included in this report as Appendix D. Some considerations and recommendations for water monitoring are briefly given here for canal water, drainage water, and groundwater.

3.4.1 Canal Water Monitoring

The district water resource officer needs to manage the district service area based on equity and efficiency considerations, which implies monitoring the following parameters relating to canal water:

- Flow discharge and water volumes entering the district service area.
- Physical condition of canals and water surface levels.
- Calculation of crop water needs.

The district canals have flow regulation gates at the intake, where water levels are read through the existing telemetry system. Flow discharge could be easily monitored at this control location with the additional measurement of gate opening. The telemetry system does not extend to the branch canal control gates. At such points, water levels and gate opening will have to be manually read to know flow discharge at this level.

3.4.2 Drainage Water Monitoring

A special concern with drainage water is its quality for reuse as irrigation supply, either alone or by mixing other sources. Some relevant water quality parameters are:

- Salt content expressed as electrical conductivity, EC, or total dissolved solids, TDS.
- Biological oxygen demand, BOD.
- Agricultural chemicals including nitrates, pesticides, and herbicides.

3.4.3 Groundwater Monitoring

Proper evaluation and planning requires at least the following data from the field:

- Number of groundwater wells (both public and private), average discharge, and relevant water quality parameters.
- Do all wells have permits? Are permit requirements satisfied with respect to well spacing and depths, pumping rates, *etc*.?

3.5 Proposal of a New Structure

Several proposals of organization have been developed by the ministry. These proposals were reviewed in addition to intensive discussions with MWRI staff at different levels. Field visits were also made to the districts for discussions with the district staff. Then, the EPIQ team developed a proposal for a new structure for the pilot IWMDs. This proposal considers the innovations of the district activities and MWRI plans and policies. The developed structure involves also determination of the roles and responsibilities of the IWMD and the required staff as well.

3.6 Seminars and Workshops to Formulate Organizational Structure

In addition to several meetings, one seminar and one workshop were conducted to discuss the new organization chart that was developed by the EPIQ team. The purpose was to investigate other issues and concerns of the proposed organization. Four different possible organizational structures were suggested by the discussions and working groups. The IWMD core working-group then met at the MWRI central level to formulate the final organizational structure proposed for an IWMD.

3.7 Definition of an IWMD

The final definition of what constitutes an Integrated Water Management District as developed by the IWMD core working-group is as follows:

The Integrated Water Management District is an entity that has sufficient manpower, material, and fiscal resources to operate and maintain all water resources under its

jurisdiction. As the primary responsibility of the district is to deliver water to the users, therefore, all of the divisions support the water distribution process to ensure that water is delivered equitably. As a result, the different water entities currently existing at the district level should be merged to constitute only one entity defined as an IWMD.

4 Organizational Structure

4.1 Organization

The developed organization of an IWMD includes mainly four sections. They are: water management and distribution section, maintenance section, planning and follow-up section and administrative section. These four sections are headed by the Markaz Officer. A markaz coordination committee consisting of 8 – 12 persons will be considered in the organization to work with Markaz Officer as an advisory unit. The committee members are not MWRI personnel but are local water user representatives. Some individuals suggested adding to the IWMD organization another management level that would be an investigation level headed by a director of works. This level would supervise the IWMD sections except for the water management and distribution section that will be supervised directly by the Markaz Officer due to its critical issues.

The Markaz Officer will be supervised by the General Director of the irrigation directorate. This means that the Markaz Officer will not report to an irrigation inspector as is done currently by the irrigation district engineer. Therefore, the irrigation inspectorate may be removed from the organization especially since the IWMD will become equivalent in authority and responsibility as a present inspectorate. Figure 4-1 shows the proposed organization of the IWMD.

4.2 Phased Implementation of Organization

After intensive discussions with the MWRI officials at the central level, they recommended developing a phased organization plan that can be implemented in sequential phases. The reason is that the IWMD is still a pilot program and all necessary facilities (equipment, buildings, *etc*.) and staff may not be available for complete implementation immediately. The first-phase organization of the IWMD will include only the pre-mentioned four sections (water management and distribution section, maintenance section, planning and follow-up section and administrative section), *i.e*., the advisory committee and director of works will not be included in this phase (see Figure 4-2). As the first phase makes progress and proves successful, the MWRI will move to the other phases.

4.3 Roles and Responsibilities

Figure 4-3 shows the divisions of each section of the IWMD organization. From this, the roles and responsibilities can be defined as follows:

4.3.1 Water Management and Distribution Section

This section is primarily responsible for determining water demands and distributing water. The section is also responsible for monitoring water quality of the irrigation and drainage networks and groundwater and monitoring the quantity of water used from canals, drains, and groundwater wells. The section has a division for studying and solving water complaints and another division for investigation of encroachments that affect the water distribution equity and pollute the water. This section contains a unit for groundwater use and development. The groundwater unit has two technicians responsible for surveying all groundwater use in the district – both official and non-official uses. The groundwater unit may propose solutions

to water resource problems and participate in plans for groundwater development within the district. The water resources development unit has primary responsibility for planning and development of all water resources of the district.

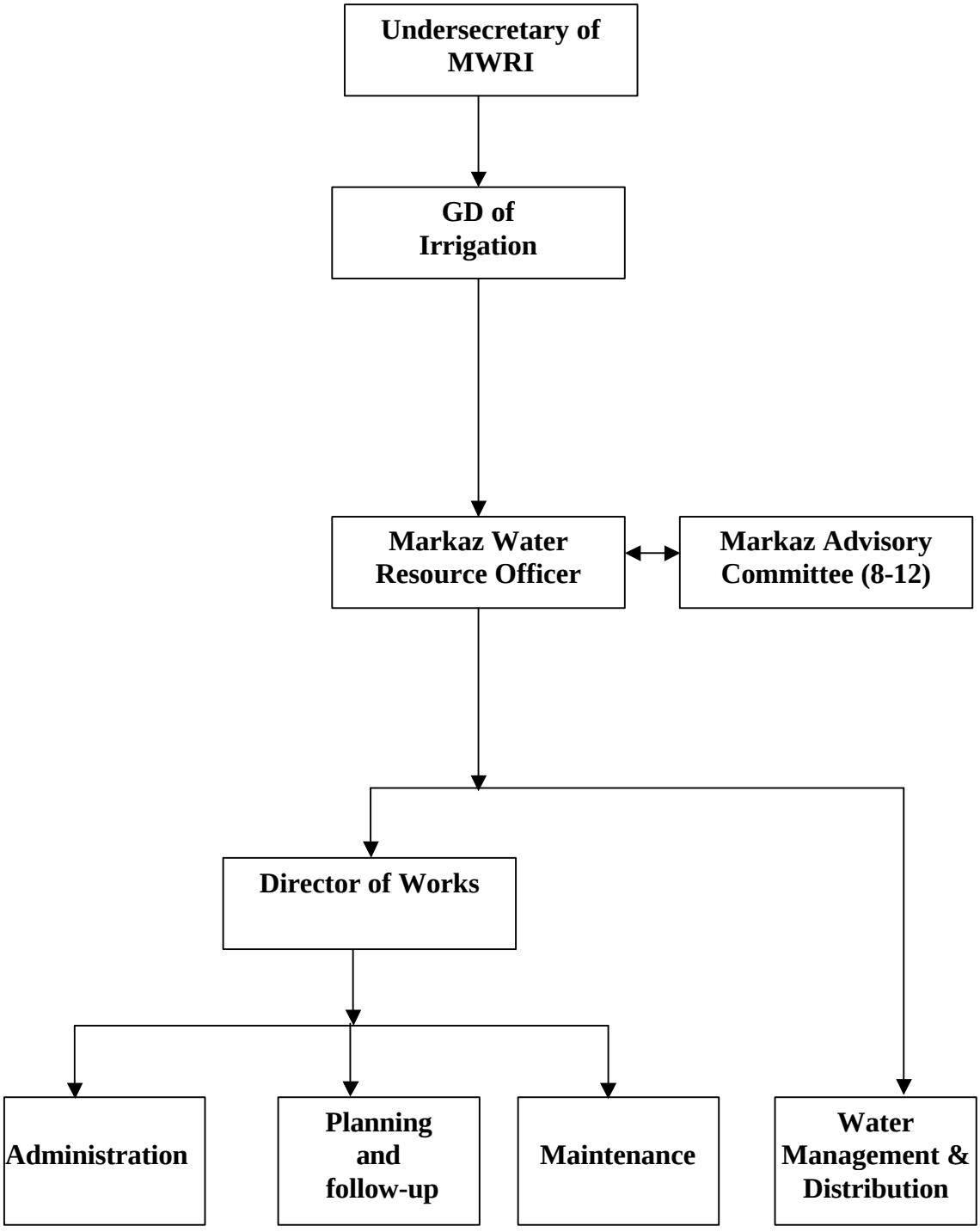


Figure 4-1. Proposed organizational chart for an IWMD.

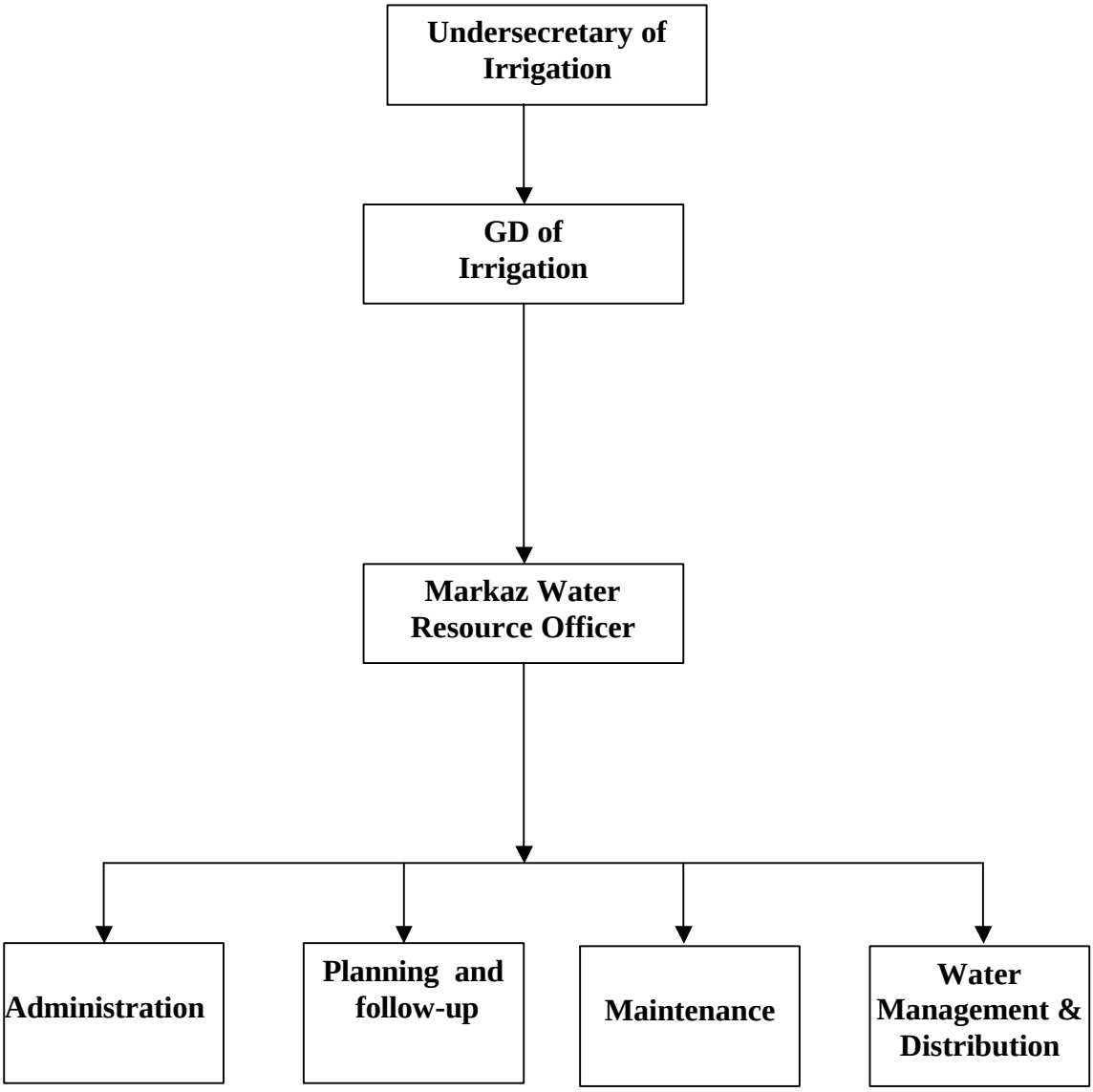


Figure 4-2. Proposed first phase organizational chart for an IWMD.

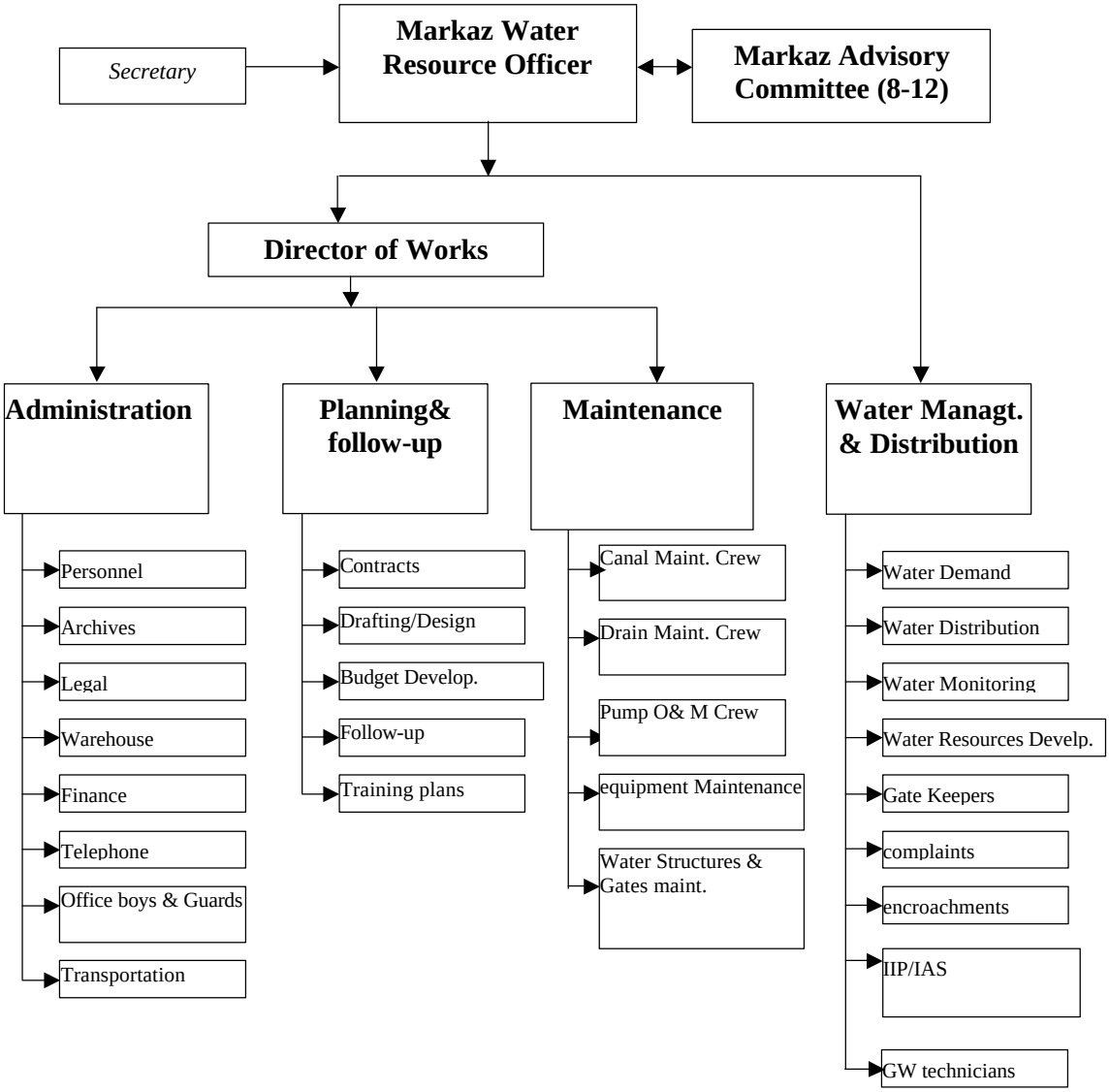


Figure 4-3. Proposed divisions and roles within an IWMD.

4.3.2 Maintenance Section

This section is responsible for maintenance activities on irrigation and drainage networks including open and closed drains. The section is also responsible for operation and maintenance of the small pump stations that are used in the irrigation network, intermediate drainage reuse pumps, and groundwater pumps. The water structures maintenance unit is responsible for routinely checking the gates and water structures and doing necessary repair on them. A preventive maintenance vehicle is needed for this unit. The maintenance section must have a workshop at the district to maintain the district equipment including cars and motorcycles.

4.3.3 Planning and Follow-up Section

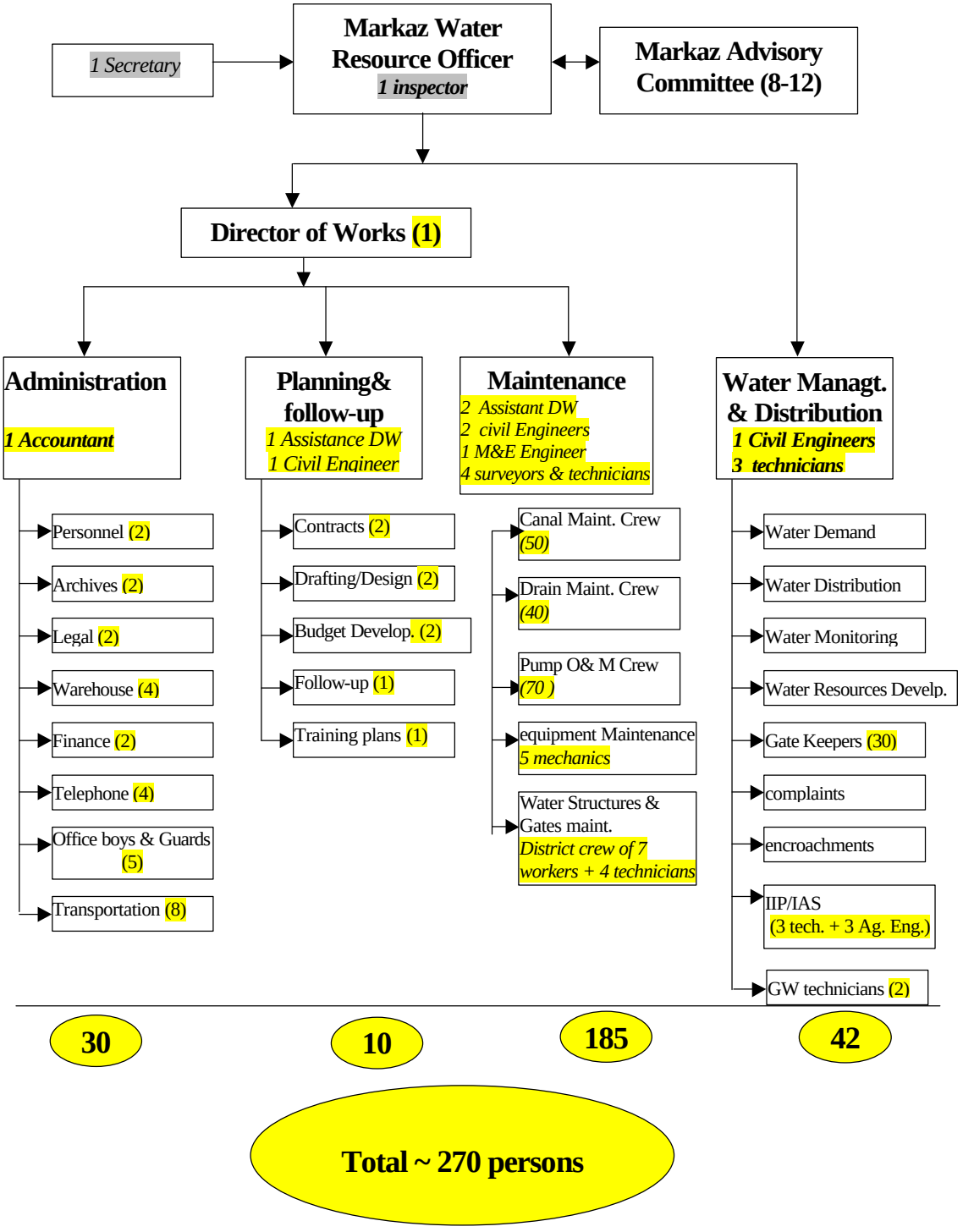
This section is responsible for detailed plans necessary for improvements to the district and for rehabilitation of drains and canals within the district. This section proposes improvements and changes to the operating plans of the district to be taken before the district council to be authorized and budgeted. The proposals would include budgets that would need to be approved. The section provides plans for contractors to work within the irrigation system and inspects the works as they are in progress. This organization supports the water management and distribution section to be able to more effectively carry out distribution of water.

4.3.4 Administrative Section

This section is responsible for all administrative duties of the district including payment of salaries, finance, archiving, complaints, encroachments, legal, secretarial, phone operators, tea boys, *etc*. The section also assists in preparing the annual budget by receiving requested budgets from each of the section supervisors. The administrative section supervisor determines the actual personnel needs and responsibilities within the district and reorganizes the staff accordingly. Each individual of the unit should have combined duties, for example: secretarial, telephone answering, and archiving. Two or three people should probably be able to handle the work of this section.

4.4 Manpower

The total manpower for an IWMD in full organization may reach 270 persons. This is not too many as all current MWRI entities (irrigation, drainage, groundwater, and M&E) at the district level will be merged into one organization. However, the task of the staff may be redistributed and redefined according to the new role of the IWMD. Figure 4-4 shows the manpower for each division of an IWMD.



Note: The numbers in parentheses are the number of staff proposed.

Figure 4-4. Proposed staff for an IWMD.

5 National IWMD Policy

Section 5.1 of this chapter presents the national IWMD policy in the Arabic language. This policy is in the form of a Memorandum together with the ministerial decree establishing the national policy and designating the two pilot districts as Integrated Water Management Districts. The first three pages of section 5.1 give the Memorandum agreed to by H. E. Dr. Mahmoud Abu Zeid. Three pages that contain the MWRI ministerial decree, No. 506, dated 10 December 2001, follow the Memorandum.

Section 5.2 of this chapter follows with an English language translation of Section 5.1 presented in the same order as in the Arabic versions.

5.1 The Signed Policy

5.1.1 Memorandum

5.1.2 Ministerial Decree

5.2 English Language Translation

5.2.1 Memorandum

IWMD Memorandum
Presented to H.E. the Minister

- Your Excellency: In recent years, a global understanding has developed that water management is best served through an integrated package of services and practices, including irrigation, drainage, conjunctive water utilization, rainfall management and flood control. It is also widely accepted that water management policies can be made more effective by directing the level of operation to localized coordination entities.

- Decentralization of water management is not a new concept for the water resources sector in Egypt. Your Excellency supported many studiers during the 1990s conducted by different agencies of the MWRI that recognized the "model irrigation district" as a means of testing decentralized management and authority at the local level.

  In addition, establishing water users associations and the activities of the MWRI to transfer the water management of some parts of the irrigation network have been at the center of a movement leading toward decentralization of the water management aiming at increasing the agricultural productivity of the water unit.

- Therefore, the benchmark C.1 of Tranche V of the Water Policy Reform Program concerned integrated water management at the district level to achieve the following objectives:

  1. Better control of water distribution at the district level according to the local conditions of water demand.
  2. Improving the performance efficiency of the irrigation and drainage at the district level and personnel as well.
  3. Integration of the of use and management of water resources at the district level and taking the suitable decision locally and on time aiming at increasing the productivity per water unit.
  4. Enable the MWRI to make the most efficient use of water from all sources.
  5. Implementation of IWMD will lead to proper planning for reorganization of the ministry and building capacity of the staff and improving management under economic and technical changes.

- Verification indicators of this benchmark are:

  1. MWRI will approve a policy to integrate all water management functions at the district level.
  2. MWRI will designate two pilot districts and initiate activities in these districts to show how the policy is to be implemented.

- Criteria for selection of the two pilot districts were developed through the benchmark in order to implement the IWMD policy. The selected pilot districts were South Zifta Irrigation District in Menoufia Irrigation Directorate and Ibrahimia Irrigation District in Sharkia Irrigation Directorate.

- It is proposed to change the current name of the irrigation districts to be "Water Resources and Irrigation District ? ??? ??????O??????? " and to establish the two pilot districts in South Zifta and Ibrahimia districts. Each district will be headed by Director of Works who will be responsible for all activities of irrigation, drainage, groundwater, drainage reuse, and operation and maintenance of the irrigation and drainage network, pump stations, and groundwater wells within the district boundary according to the attached organization chart.

- This is then presented to Your Excellency to agree on considering the IWMD policy one of the MWRI policies and issuing the required decree concerning the establishment of the two pilot areas mentioned above and to be monitored and evaluated.

Director of
Water Policy Advisory Unit

18/ 11/ 2001
(Eng. Gamil Mahmoud Elsayed)

Approved,

Signature Dr. Mahmoud Abu Zeid
8/12/2001

5.2.2 Ministerial Decree

Ministerial Decree
No. 506 for the Year 2001
10/ 12 /2001

Minister of Water Resources and Irrigation:

In reference to:

- Irrigation and Drainage Law No. 12 for the year 1984 and Law No. 213 for the year 1994 and their executive regulations.
- With regard to Law 47 for the year 1978 regarding state employees organizations.
- With regard to Agricultural Policy Reform Program (APRP) and Water Policy Reform Project (WPRP) and its benchmarks related to the improvement of the irrigation and drainage systems and increase the efficiency of water management.
- And based upon the WPRP-benchmark on Integrated Water Management Districts.

Decided

Article No. 1

Changing the existing name for Irrigation Districts to "Water Resources and Irrigation Districts".

Article No. 2

Modifying the organization chart for the two water resources and irrigation districts in the two pilot areas " South Zifta District in Menoufia Irrigation General Directorate and Al-Ibrahimia District in West Sharkia Irrigation General Directorate" to follow the attached organization chart. Providing the two Districts with all the necessary human resources and equipments to achieve the desired integrated water resource management (irrigation, drainage, groundwater, and any other sources of water) on the District level.

Article No. 3

Water resources management activities must be integrated on the District level in the two previously mentioned pilot districts in Article No. 2. The District director has to supervise all the activity of the irrigation, drainage, groundwater, drainage water reuse, O&M irrigation and drainage networks, pump stations, and groundwater wells within the district's borders.

Article No. 4

The pilot experiment previously mentioned in Articles No. 2 & 3 must be monitored and evaluated to make sure that it will meet the aimed targets before expanding its application nationwide.

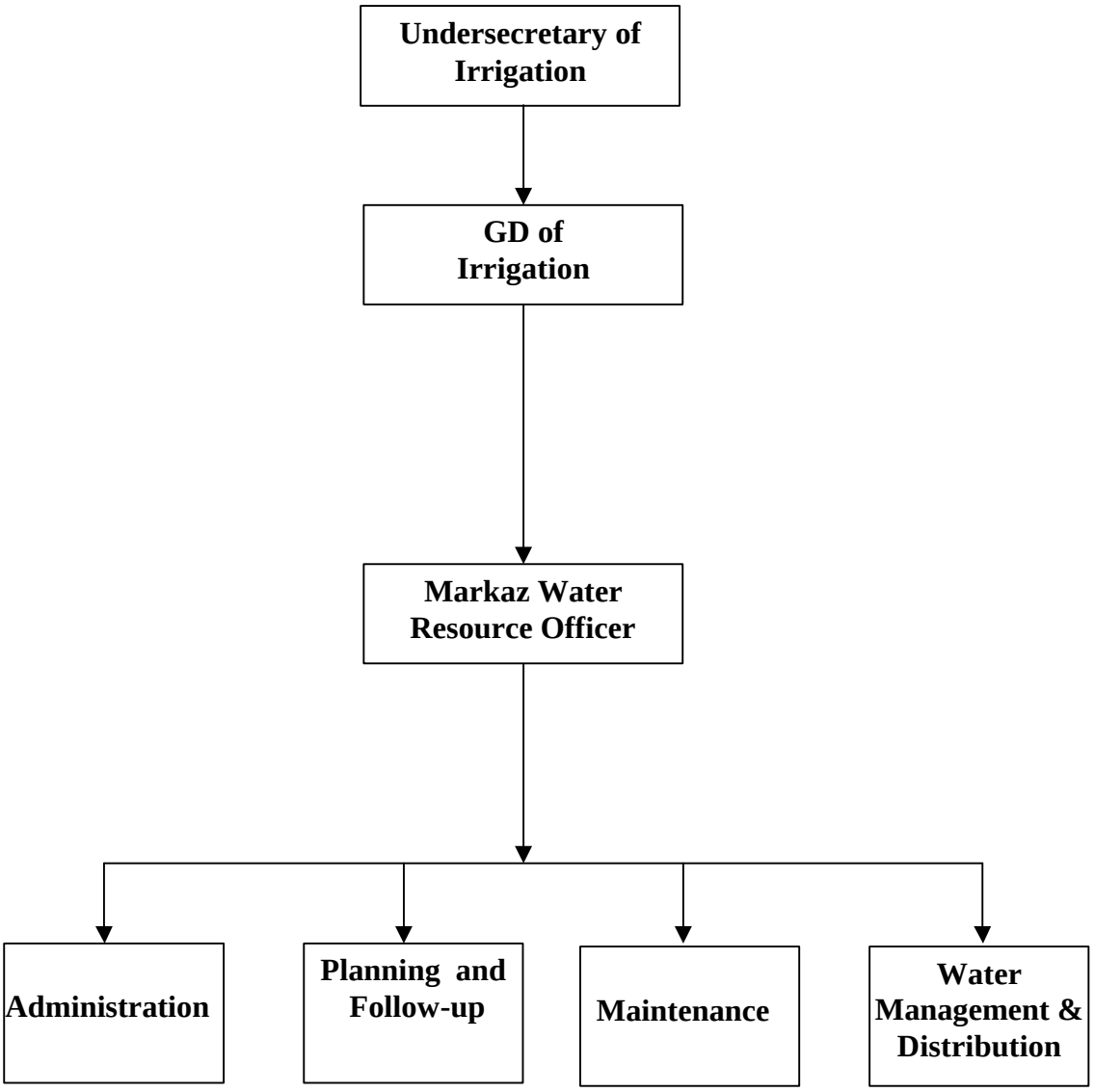
Article No. 5

This decree is effective from this date and executable by all concerned agencies.

Minister of
Ministry of Water Resources and Irrigation

Dr. Mahmoud Abu Zeid

Organization Chart for IWMD



6 Implementation Recommendations

As the MWRI begins to implement the national policy creating Integrated Water Management Districts, it is recommended that:

1. The MWRI delegate authority for management of district resources to the District Water Resource Officer (more briefly called Officer in the following).

2. The Officer delegate authority to the district unit supervisors or supervisory engineers to organize their staff for most effective execution of their duties. This includes the authority and responsibility to redistribute positions, if necessary, and personally train and coach individuals under their supervision.

3. Each unit supervisor be responsible for training staff in their duties.

4. The MWRI provide a budget for the Officer from existing Directorate funding for operation, maintenance, and salaries. Savings in salaries should be used in maintenance.

5. The investment portion of the budget be used to purchase an excavator, drain washers, transportation, wagons, ditcher, tools and other equipment required to adequately maintain the facilities. The district should also budget for replacement of that equipment.

6. The maintenance portion of the budget be used to purchase maintenance materials and contract with small private entities as required for maintaining the canals.

7. Water be distributed equitably among all of the branch canals.

8. Water be measured at each branch canal to ensure equitable distribution. This measurement initially could be by gate rating curves. Each district should purchase their own measurement set with transportation to measure canals regularly.

9. Each district provide for water sample collection for analyzing water qualities and conduct monitoring of quantities and depths in the canals and drains and groundwater quantities withdrawn for irrigation.

10. Alternative sources of water such as groundwater, drainage reuse, and effective precipitation be used as much as possible to supplement Nile River water. The IWMD Officer and his staff, in coordination with higher-level authorities within the Ministry of Water Resources and Irrigation, should assess these sources and decide how these resources contribute to meeting a part of the water requirements of the district.

11. A goal of reusing one million cubic meters per 1000 feddans per year be set for those districts where drainage water is reusable. The reuse pumping plants should all be similar small plants (package plants) that could supplement branch canal water needs. A spare pump should be installed at each plant for operation rotation and for water shortages. Pump usage should be continuous during the branch canal rotation. Excess

water supply from the Nile should result in shutting off the pumps. These small pumping plants would best be served by an electrical supply source if possible.

12. Those districts where groundwater is available set goals for groundwater utilization by private development of wells. Groundwater should not be considered a district responsibility. Use of groundwater as a continuous supply should be encouraged as much as possible. Groundwater can play a huge role in meeting the municipal and industrial requirements as long as it is protected to produce good water quality. The district should monitor annual use from the groundwater pumps within the district boundaries and ensure groundwater protection.

13. Canal and drain maintenance be by district staff with limited contracting to small private companies.

14. Equipment maintenance be by district staff unless there is not sufficient work to keep the employee continuously busy. Maintenance that cannot be performed by staff should be performed by local mechanics. Preventative maintenance of the equipment is still the responsibility of the district and needs to be budgeted.

15. A ditcher and several heavy chains be purchased for cleaning the canal.

16. Canals be dredged only as needed to restore design cross-sections. Banks should be trimmed using a ditcher to dress the canal banks and clean out grass.

17. Washer machines be used to flush collector drains at least once per year. This work should be transferred to the benefited landowners as soon as possible.

18. When the washers are not in use, tractors be used to pull the ditcher and for other construction work on the canals and drains.

19. One or two construction wagons be purchased to provide material transportation to work sites.

20. Canals and drains be cleaned to ensure good flow of water to and away from the farms.

21. The district monitor water quality and communicate the results to the water users of the branch canals and drains.

22. A Coordination Committee for the district be formed with a primary purpose to communicate more effectively with the water users. Monthly meetings should be held in the locations rotated throughout the district to provide more access and information to the water users on district activities.

23. The district be an organizing catalyst in obtaining a fenced solid waste disposal area for each branch canal or community.

24. The district encourage some form of sewage treatment for each community by utilizing the threat of violations of the dumping laws. Most small communities could consider a sewage lagoon with a deep anaerobic pit for decomposition of the solid wastes. This

would not require excessive area or cost and would not be a public nuisance but would need to be fenced.

25. Districts be formulated as much as possible to be responsible for a command area so that water is delivered to the head of a canal by the Directorate and the district is responsible for the area. South Zifta is a district that probably should be expanded to include the head of the two canals that deliver water to the branch canals.

7 References

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2. Modern Irrigation Systems for Irrigation Districts, Water Policy Advisory Unit, MWRI, 1999.

3. A proposal for Improvement of Irrigation and Drainage Districts, Irrigation Sector, MWRI, 1997.

4. Water Resources, Irrigation Operations and Institutional Issues: An Analysis of the Ministry of Public Works and Water Resources, GOE, Report No. 2, IIMI, Strengthening Irrigation Management in Egypt, December 1995.

5. An Action Plan for Strengthening Water Resource Management in Egypt, Report No. 3, IIMI, Strengthening Irrigation Management in Egypt, December 1995.

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10. Opportunities for Improving Water Management in the Sharkia Command Area, Draft Report submitted to IMS Project, Planning Sector, MPWWR, and to USAID. Logan, UT: Utah State University, September 1995.

11. Evaluation of the Planning Distribution Model in the Sharkia Directorate, Logan, UT: Utah State University, November 1995.

12. Improved Operating Procedures Manual for the Sharkia Directorate. Logan, UT: Utah State University, November 1995.

List of Appendices

Appendix A

Table A-1. Agencies, Groups, and Individuals Within MWRI Involved in IWMD Activities.

1.	Eng. Ali Morsi	Head of Irrigation Department
2.	Eng. Mohamed Fathy	Head of EPADP
3.	Dr. Hesham Mostafa	Head of WCU
4.	Eng. Mohamed Hamed	WPAU Engineer
5.	Eng. Abdel Hamid Elgayyar	General Director for Irrigation, Menoufia
6.	Eng. Nadia Hafez	Former General Director for Drainage, Menoufia
7.	Eng. M. Abdel Kawy	General Director for Drainage, Menoufia
8.	Eng. Mohamed Samir	Irrigation Inspector of Zifta
9.	Eng. Azza Abdel Hamid	District Engineer for Irrigation, Zifta
10.	Eng. Gamal Gergis	Director of Irrigation Works, Zefta Inspct.
11.	Eng. Fatma Abdel Aziz	District Engineer for Drainage, Zifta
12.	Mr. Ezzat Abdel Moaty	Technician of GW District, Zifta
13.	Mr. Mohamed Gaber	Technician of Irrig. District, Zifta
14.	Eng. Moghmaed Elwarraki	Undersecretary of Irrigation, Sharkia
15.	Eng. Gamil Farahat	General Director of Irrigation, West Sharkia
16.	Eng. Ghoneim Abdel Meguid	General Director Drainage, South Sharkia
17.	Dr. Khaled Wasif	Field coordinator, Water Boards in Zagazig
18.	Eng. Abdel Fattah Elbaz	District Engineer for Irrigation, Ibrahimia
19.	Eng. Ibrahim Tolba	District Engineer for Drainage, Ibrahimia
20.	Eng. Ibrahim Ezzat	Director of Works of Drainage, Sharkia
21.	Ag. Eng. Mohamed Abou Elseoud	Ag. Extensioinst, Ibrahimia Drainage District
22.	Mr. Said Abdel Latif	Irrigation District Administrator, Ibrahimia

Appendix B

Details for the Zifta Districts

Figure B-1. South Zifta Irrigation District boundaries before forming the IWMD.

Figure B-2. South Zifta Integrated Water Management District boundaries.

Figure B-3. Zifta Drainage District boundaries before forming the IWMD.

Figure B-4. Zifta Drainage District boundaries after forming the IWMD.

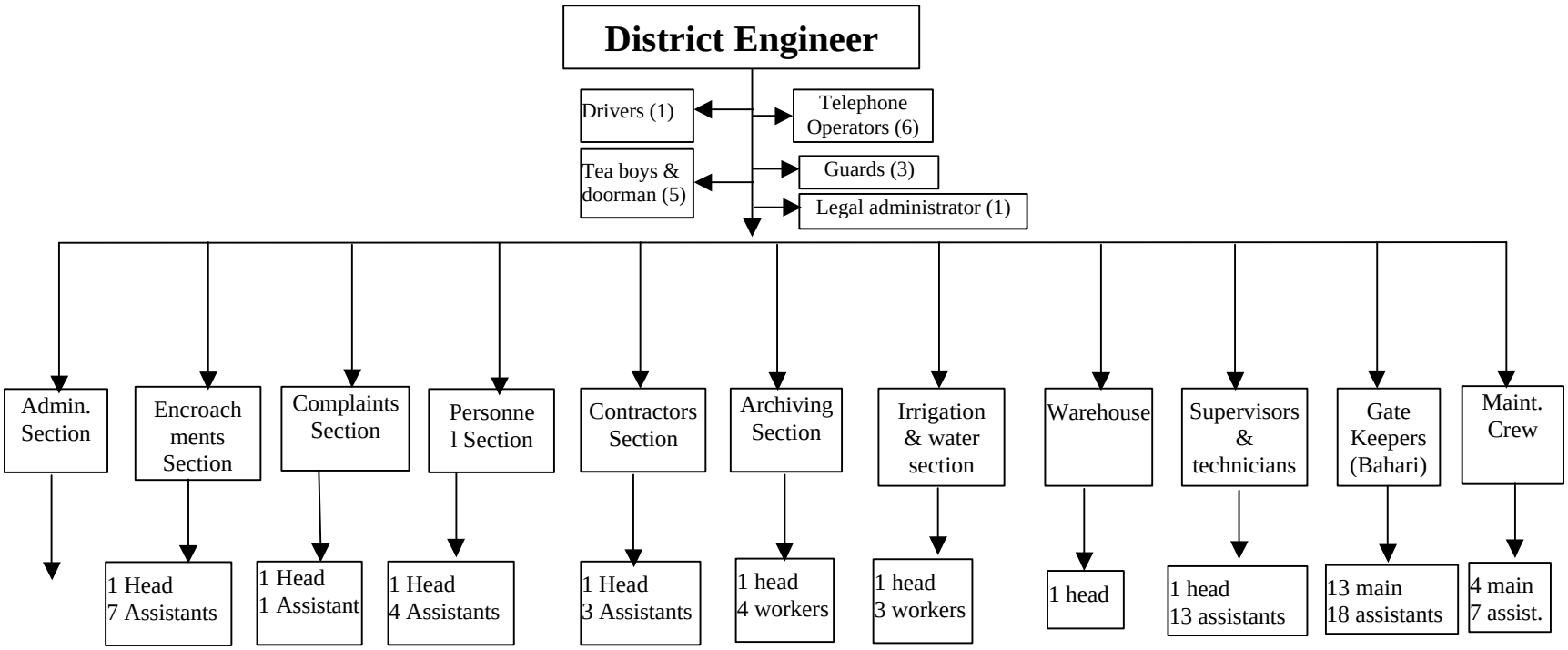


Figure B-5. Current organizational structure of South Zifta Irrigation District.

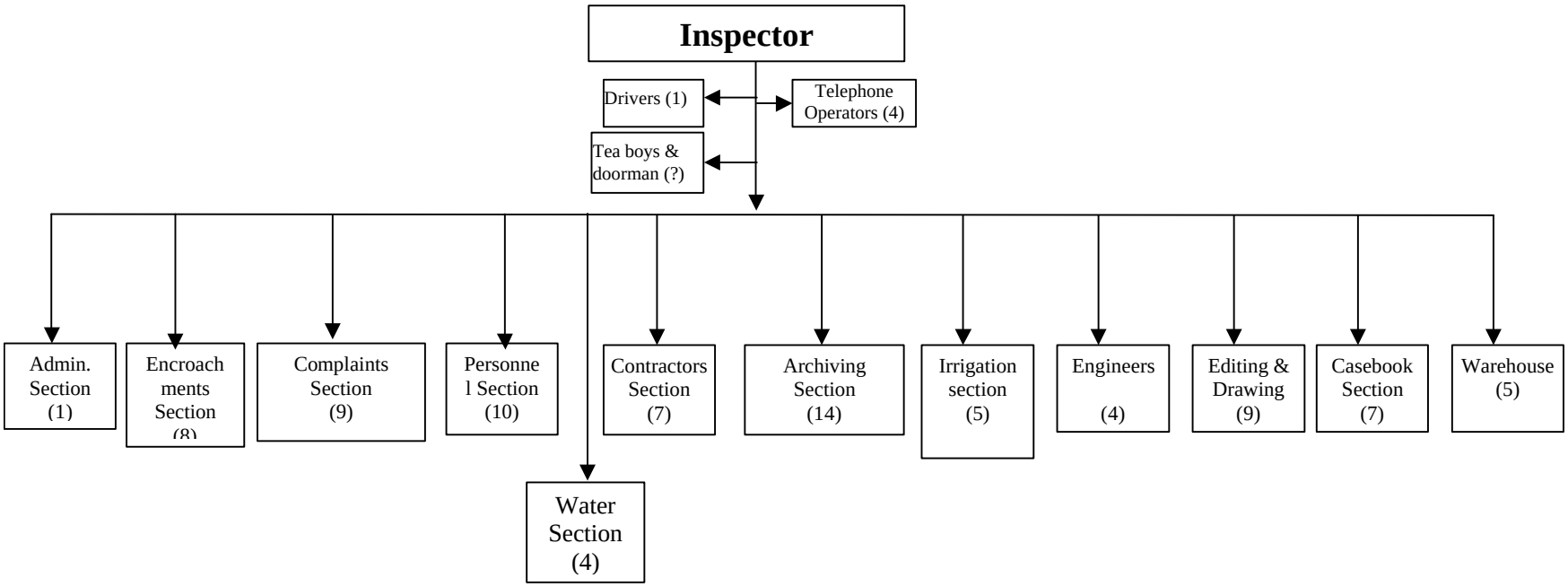


Figure B-6. Current organizational structure of Zifta Irrigation Inspectorate.

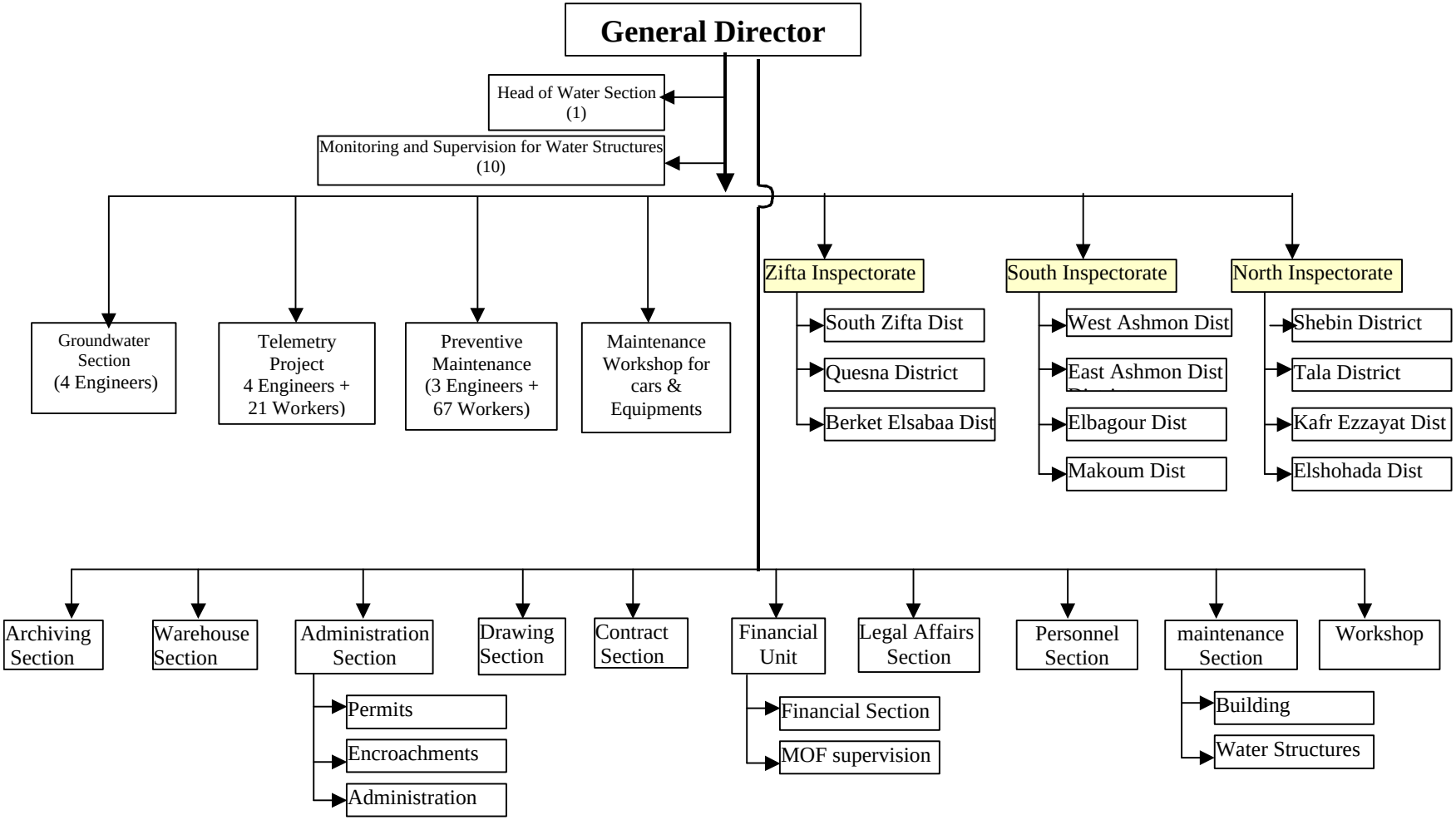


Figure B-7. Current organizational structure of Menoufia Irrigation Directorate.

Appendix C

Details for the Ibrahimia Districts

Figure C-1. Ibrahimia Irrigation District boundaries before forming the IWMD.

Figure C-2. Ibrahimia Integrated Water Management District boundaries.

Figure C-3. Ibrahimia Drainage District boundaries before forming the IWMD.

Figure C-4. Ibrahimia Drainage District boundaries after forming the IWMD.

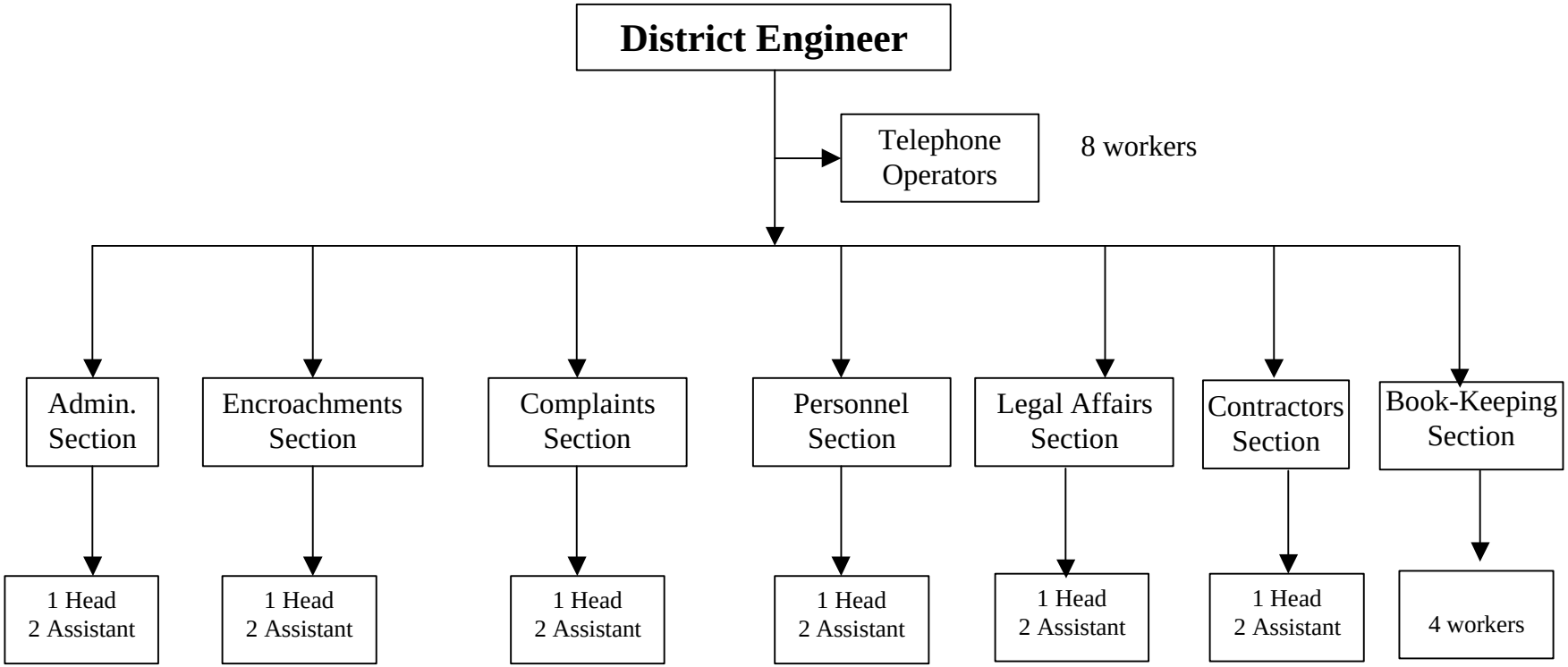


Figure C-5. Current organizational structure of Ibrahimia Irrigation District.

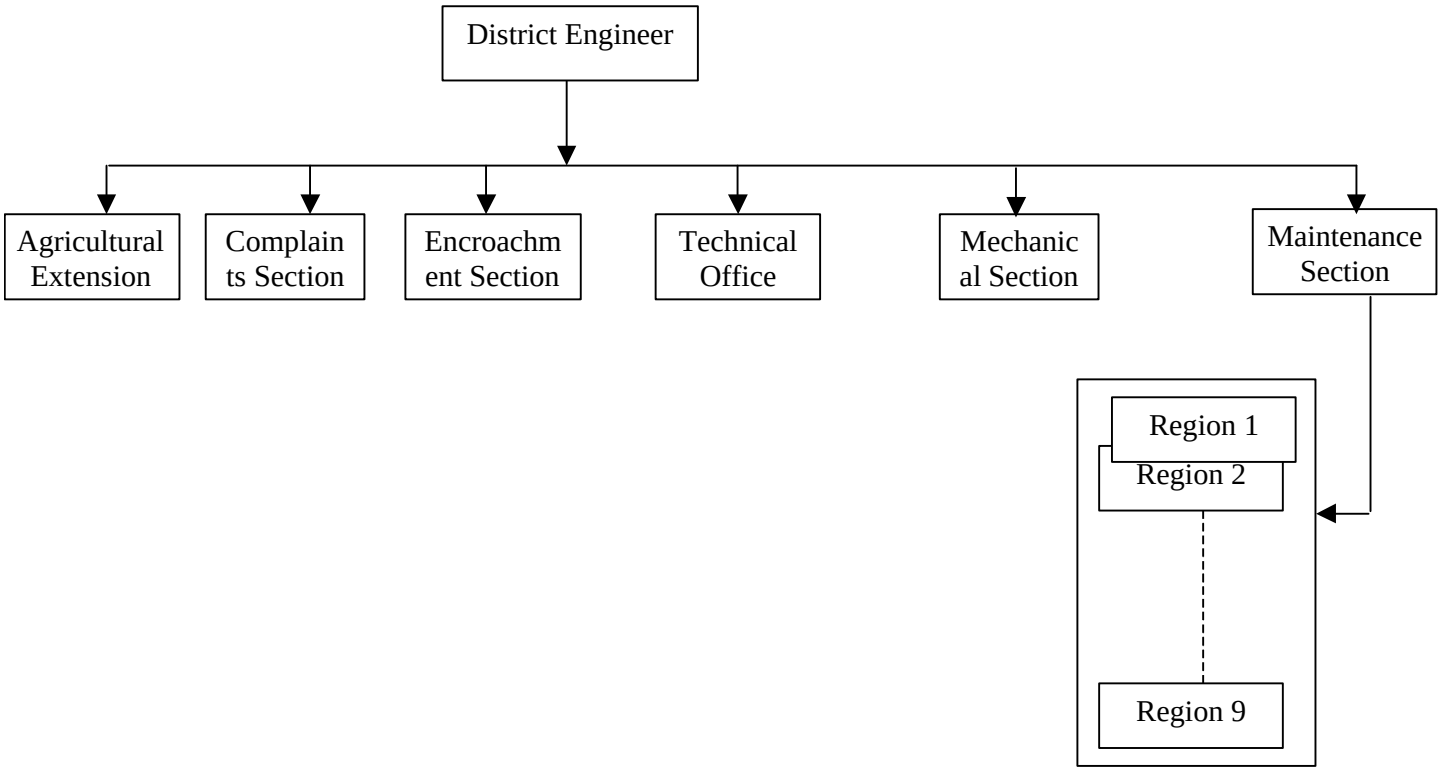


Figure C-6. Current organizational structure of East Ibrahimia Drainage District.

Appendix D

Water Monitoring Program

for

Integrated Water Management Districts

Dr. Ramchand Oad
August 2001

Contents of Appendix D

Executive Summary

Review of Existing Monitoring Practices

Following recommendations for a water monitoring program are based on a review of existing irrigation and drainage water monitoring practices in two pilot districts, and discussions with senior and field level staff of the Ministry of Water Resources and Irrigation.

Canal Water

The review indicated that the flow discharge and amounts are monitored in the main canal network, which is necessary since water allocation and distribution among all General Directors are on volumetric basis. However, flow discharge and water volumes are not measured as water enters the district canals and related distribution system (branch canals and mesqas). Within the district service area, the present water monitoring system essentially measures water levels, to maintain a certain water head at key delivery points so that water flows, by gravity, from main to branch canals and eventually to mesqas.

Groundwater

The Groundwater Sector does not yet have staff at the district level, and the water users are installing private wells without proper licenses. The groundwater development is not properly monitored, both from water quantity and quality considerations.

Reuse of Drainage Water

The Ministry uses drainage water by pumping from the main drains to the main irrigation canals. Mixing of irrigation water with drainage water at the intermediate canal level is currently not practiced. Farmers, however, do pump from drains adjacent to their lands, especially in times of water shortage. The drainage engineer at the district office does not monitor water quantity and quality in any of the drains. There is a future option to mix drainage and irrigation water at the intermediate level, and then it will be necessary that the drain water quality be monitored at the local level.

Proposed Water Monitoring Program for IWMDs

Canal Water Monitoring

The district engineers need to manage their service area based on equity and efficiency considerations, which implies monitoring following parameters for the canal water:

- Flow discharge and water volumes entering the district service area.
- Physical condition of canals and water surface levels.
- Estimation of crop water requirements.

The district canals have flow regulation gates at the intake, where water levels are read through the existing telemetry system. Flow discharge could be easily monitored at this control location, with the additional measurement of gate opening. The telemetry system

does not extend to the branch canal control gates. As such, water levels and gate opening will have to be manually read to know flow discharge at this level.

Groundwater Monitoring

For proper evaluation and planning, it is necessary to know at least following data at the field level.

- Number of groundwater wells, public or private, average discharge, and relevant water quality parameters.
- How do water users get permits to install wells? Are they following specifications (spacing and depth, pumping rate, etc.)?

Drainage Water Monitoring

A special concern with drainage water is its quality, for reuse with irrigation water. Some relevant water quality parameters are following.

- Salt content, in terms of electric conductivity,
- Biological oxygen demand, BOD, and
- Agricultural chemicals including nitrates, pesticides and herbicides.

Program Implementation

Organization

A Planning and Water Monitoring Unit should assume responsibility for irrigation, drainage and ground water monitoring.

Needed Resources

The Planning and Water Monitoring Unit will need to be staffed with one engineer, who will be in charge of the Unit, supported by appropriate number of technicians (at least one each for monitoring of irrigation, drainage and groundwater data).

To measure flow discharge at the district canal gates, appropriate hardware must be installed to measure the gate opening and then transmit the data through the existing telemetry system. Also, flow-measuring meters will be required for calibration. For water quality measurements in irrigation and drainage canal, simple field kits are available, which are fairly inexpensive and easy to use. The Monitoring Unit should, at minimum, have the following field kits.

- Electrical conductivity meter, for testing salt-content of water,
- pH meter, and field kits for Nitrogen content.

The Drainage Authority has established regional laboratories that should be used (there is at least one in Zigazig). The laboratory can be used to check the accuracy of field kits, and analyze samples for more involved measurements such as BOD.

Background

Irrigation Policy Reforms

Decentralization

The EPIQ Water Policy Reform Program advises the Ministry of Water Resources and Irrigation (MWRI) with respect to improved policy assessment, planning, and irrigation system management. The EPIQ Team members are currently working on a policy initiative to decentralize water management, by devolving more decision-making to the district offices and by integrating all water management functions at the district level. The Integrated Water Management District (IWMD) would then provide a comprehensive package of services to the farmers including irrigation, drainage, and ground water use.

IWMD Program

The first important step is to formulate a suitable organizational structure for the IWMD, and the EPIQ team is actively working on this issue with the expert help of Dr. Ken Mitchell[1] (See Appendix E). A related concern is the general lack of integrated planning and performance monitoring of the irrigation and drainage system, especially at the district level. It is recognized that for IWMDs to properly manage the system, the district officers must monitor its current performance and then take the necessary steps to improve it. This report addresses the concern related to performance monitoring; that is, to have a water monitoring program that can be used as a decision-making tool for system management.

Terms of reference

Design a Water Monitoring Program

In general terms, the assignment required the water monitoring specialist to:

> "investigate, design, and implement a sustainable water monitoring program for the pilot districts including all available sources of supply".

The Water Monitoring Specialist was able to investigate and design the program, and provide guidelines for its implementation. Actual implementation of the program will depend on the Ministry and its field staff, and that will take time. Specifically, the specialist was able to carry out the following assigned tasks.

1. Review the existing practices of water monitoring in the pilot districts and assess the strengths and weaknesses of such practices.
2. Identify the key locations for water flow measuring in the pilot districts that could be utilized for water allocation.
3. Recommend a suitable water-monitoring program in each of the pilot districts including monitoring locations, parameters to be monitored, responsibilities, method of measurements and recording.

[1] Dr. Mitchell's report "Function and Organization of an Integrated Water Management District" provides details about the water management issues related to irrigation and drainage, and the need for integration. This report focuses on the concern of water monitoring and measurement that is mentioned in the Mitchell report.

4. Determine the needs/requirements for implementing the proposed water-monitoring program in terms of staff, training, and equipment.
5. Develop a written plan for implementation of the sustainable monitoring program in the pilot districts.

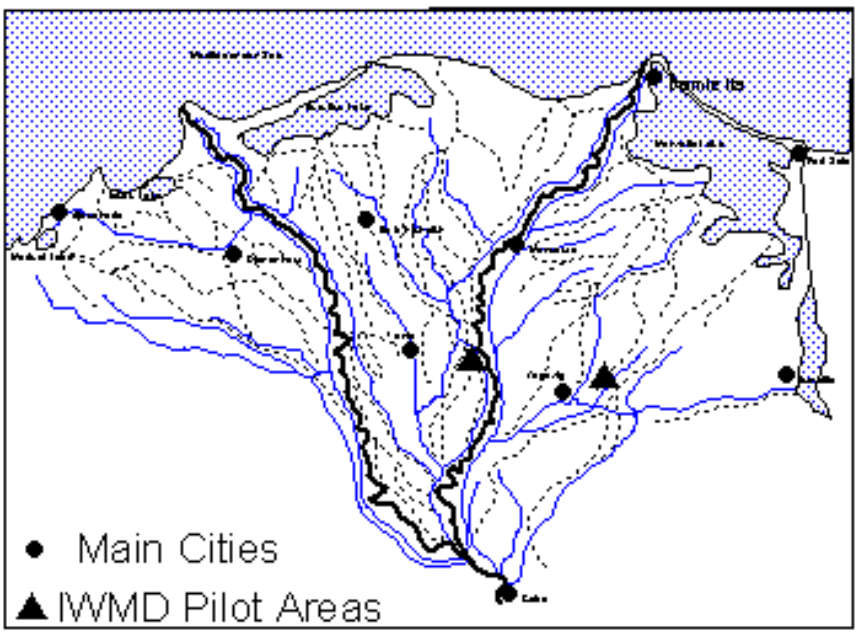
Purpose for Water Monitoring

The proposed monitoring program is expected to promote "measurement-based management", where information on water quantity and quality is used as an operational tool for irrigation system management. The monitoring program suggested here specifically targets the district management level. However, the basic concepts and elements are applicable at any other management level of the irrigation and drainage system. Specifically, the water-monitoring program will help the District Engineer:

- To better match irrigation water supplies to the crop water requirements within the service area. This is necessary in order to be consistent with the future Ministry policy of reducing mismatch between water supplies and demands.
- To better "manage" rather than merely "operate" the various water resource elements of irrigation, drainage and groundwater in an integrated manner. This is in line with the objectives of the Integrated Water Management Districts (IWMD) program.
- To better support the Irrigation Management Transfer Program, where the district offices will be responsible for delivering a given water volume to various branch canals.

The specialist visited both pilot sites for the IWMD program, South Zifta near Tanta and Ibrahimia near Zagazig (Figure D-1), related offices of the General Directors and Undersecretary, the Groundwater Sector and the Drainage Research Institute. A complete list of the offices and persons interviewed appears in Attachment A.

Figure D-1. Location of IWMD Pilot Districts in the Delta.



Irrigation Organization

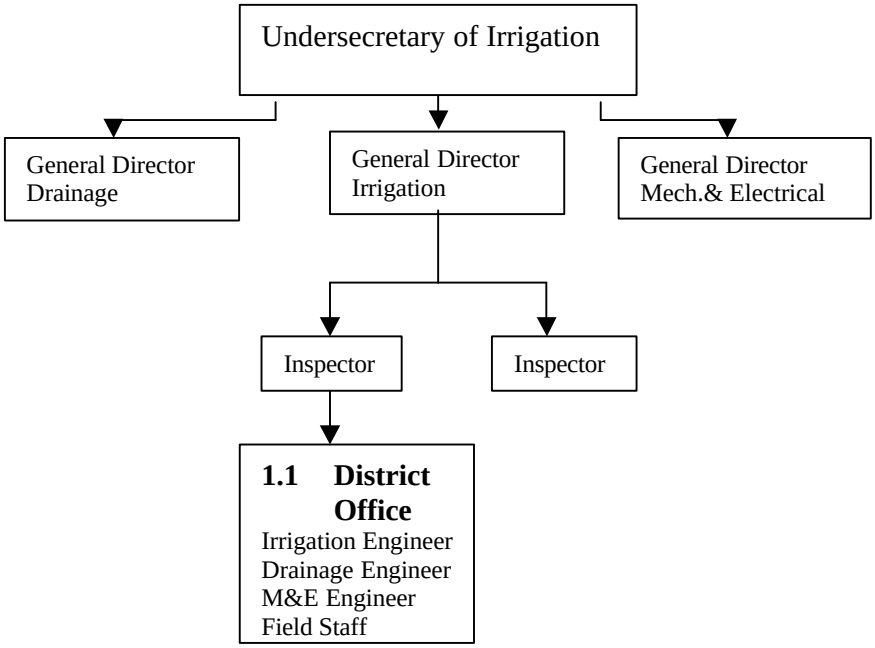
Field Level Organization

Irrigation Districts are fundamental units of the Ministry since the field offices maintain and operate the irrigation system, and provide water to the farmers. The district is headed by an irrigation engineer with assistance from a drainage engineer, technical and administrative staff. The district office serves, on the average, an agricultural area of 50,000 feddans. Inspectors, who in turn report to the General Director, supervise the district officers. The General Director, on the average, supervises eight district offices, which is a service area of 400,000 to 500,000 feddans. The regional directorates of irrigation, drainage and mechanical and electrical operations are coordinated through the office of the Regional Undersecretary of Irrigation, who represents the Minister (Figure D-2. Field level organization of MWRI).

Central Organization

The Ministry of Water Resources and Irrigation has three technical departments that manage water to support irrigated agriculture in the country. The Irrigation Department is responsible for managing the irrigation infrastructure and for delivering water to the water users, the Drainage Authority is responsible for maintaining the drains, and the Mechanical and Electrical Department is responsible for operating and maintaining all mechanical facilities including pumps for drainage reuse and groundwater utilization. All three departments have separate lines of accountability to the Minister, with separate budgets. At the district operational level, however, work of these departments must be well coordinated since all their activities affect water delivery to the farmers.

Figure D-2. Field Level Organization of Irrigation.

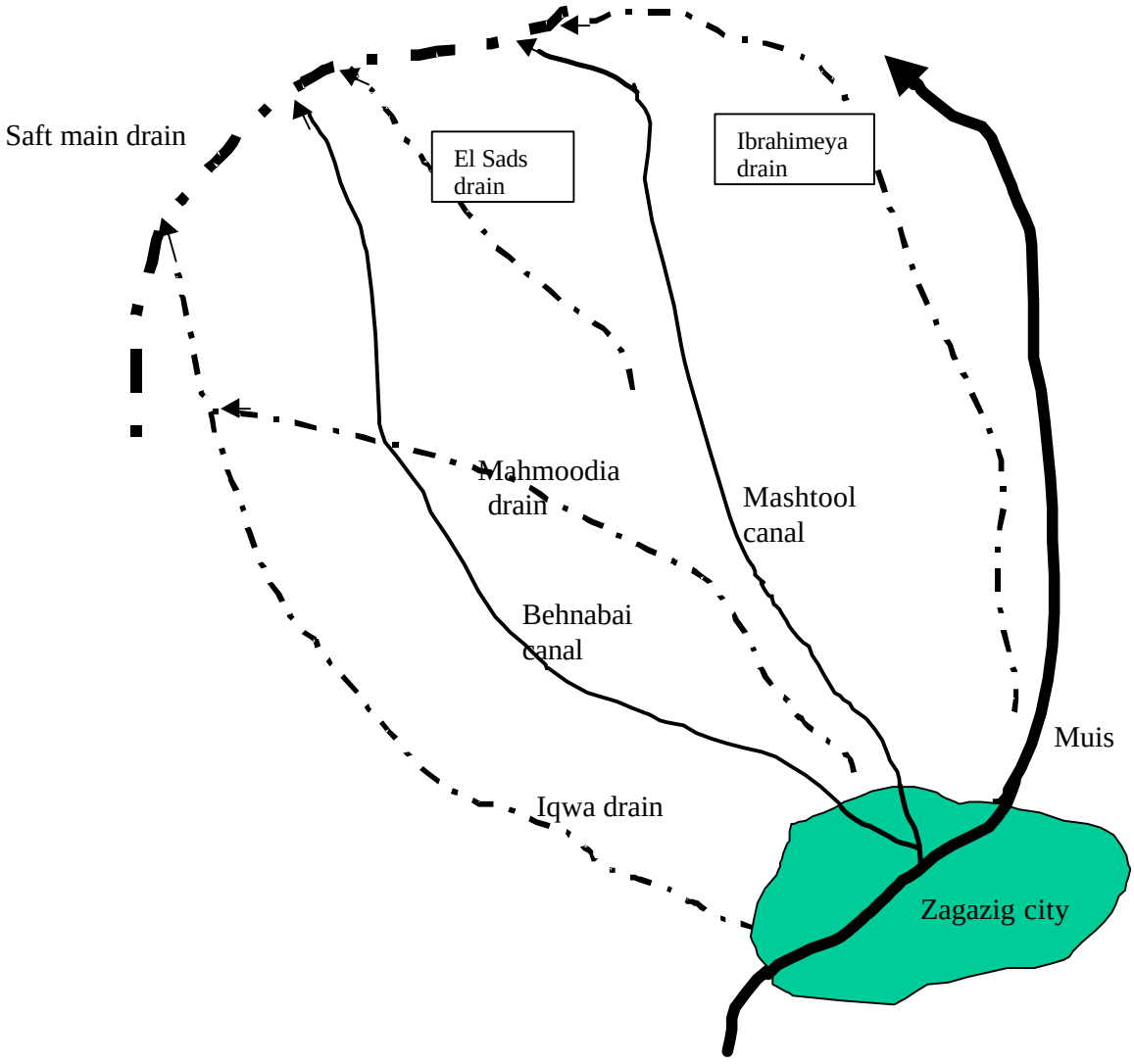


System Operation for Water Distribution

Field Operations

The district engineer has a large responsibility that includes an efficient and equitable water distribution among all water users. The district receives water through two or three main district canals, each of which feeds several branch canals. The branch canals in turn supply water to the field channels (mesqas), where from the farmers pump it to irrigate their lands (Figure D-3). The district field staff must maintain sufficient water amount and head in the district canals so that water can flow by gravity into branch canals and their mesqas. Since most canal sections are very large, the district staff often puts unnecessary large quantities of water into the to obtain the required water surface level (hydraulic head). Water surface levels, therefore, become the controlling parameter for canal operations rather than the flow discharge. And, this limitation perhaps explains why the field staff monitor water levels and not flow discharge in their canals.

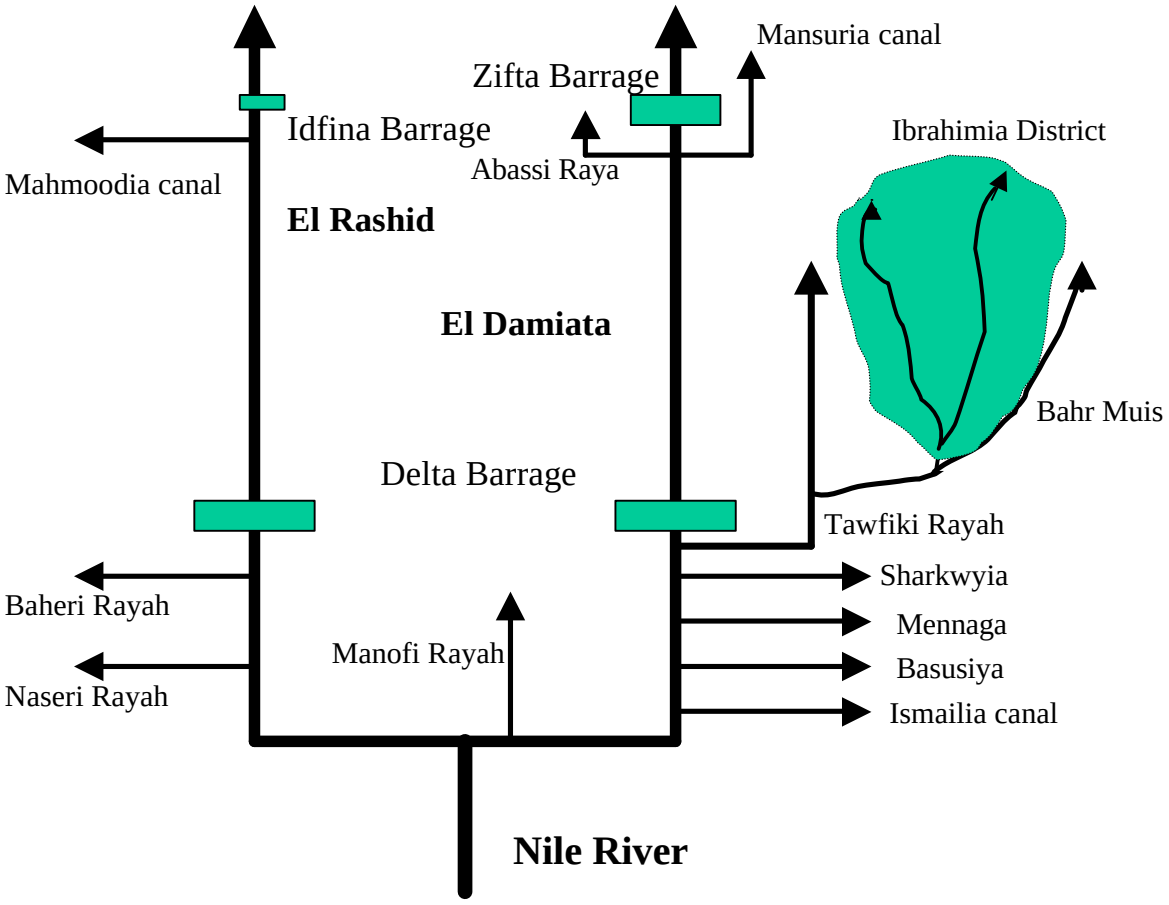
Figure D-3. A Typical District Service Area – Ibrahimeya District.



Main Canals

Water diversions at the Delta Barrage, and smaller diversions at the Idfina and Zifta barrages, are the primary source of irrigation water for the delta region (Figure D-4). A network of main canals then conveys water to service areas of various directorates and eventually to the districts. The Ministry has a Central Directorate of Water Distribution in Cairo with two field offices, one for the Upper Egypt and the other for the Lower Egypt. This directorate decides how much water is released in main canals at various diversion points on the Nile, and then how that water is allocated for use among various directorates. Water diversion and its distribution among directorates, therefore, are on volumetric basis and that is how water is monitored in the main system. As mentioned, at the field level, water is not monitored for flow discharge and volume, but only for water surface levels.

Figure D-4. Irrigation System in the Delta.



Review of Current Water Monitoring Practices at the District Level

Canal Water

Water Monitoring

Canals that irrigate the district service area are normally second or third level canals, meaning that water has already passed through a network of main canals since its diversion from the Nile River. At the main canal control points, flow discharge and volumes are monitored to ensure that all irrigation directorates receive their fair share. But, water discharge and amounts are not measured in the district canal and its distribution system (branch canals and mesqas). Presently, the management level of General Director, rather than the District, appears to be pivotal for ensuring an equitable water allocation and its efficient use. In the future, however, the efficiency considerations will require monitoring of water volumes at the district level also, so that the water supplies can be better matched to the crop water demand.

The Ibrahimya District, for example, receives irrigation water from two canals: Mashtool and Behnabai that take water from the main canal Muis, which receives water from the Tawfiqi Rayah originating at the Delta Barrage (Figure D-4). Canal water level and flow are monitored at the intakes of Tawfiqi Rayah and Bahr Muis canal, but not for the district canals Mashtool and Behnabai. The South Zifta District receives irrigation water from three canals: El-Atf, El-Khadrawiya, and El-Sahel that take water from the main El-Manofi Rayah, which originates at the Delta Barrage.[2]

Service Area

Average service area of most irrigation districts in the Delta is reported to be 50,000 feddans. The service area of the Ibrahimya district is about 59,000 feddans, and that of S.Zifta is 42,360 feddans. Farmers within the service area of a given district canal receive water on a turn basis, which in summer for non-rice crops is normally 5 days on followed by 10 days off. For rice service areas, the water rotation is 5 days on and 5 days off. For example, the Behnabai canal in Ibrahimya district is operated on a three-turn rotation:

- Intake to km 8: 5 days on followed by 10 days off
- Km 8 to end: 5 days on followed by 10 days off
- In the third five-day period: water is shutoff in the whole canal.

On Mashtool canal, there is two-turn rotation:

- Intake to middle: 5 days on followed by 5 days off
- Middle to end of district 5 days on followed by 5 days off.

[2] The main body of the report includes limited field information, which is necessary to illustrate a basic thought. Detailed information on the pilot IWMD districts is presented in Attachment C for the Ibrahimya District and Attachment D for the South Zifta District.

The Mashtool farmers receive more water since they cultivate more rice. The farmers in the South Zifta District receive water on a turn basis also, which in summer is 5 days on followed by 10 days off.

System Operation

The district canals have flow regulation gates at the intake, where water levels upstream and downstream of the gates are read through the telemetry system. In case where two districts share the same canal, their boundary is defined at a check regulator where water level can be controlled and measured. The water level is used to monitor a district's share, and not necessarily the flow discharge or water volume. That is, the Inspector delivers water to the District Engineers at a certain level, measured at the canal intake or at the boundary regulator. Flow discharge and water volume supplied to the districts are not monitored and measured.

The district canals are further provided with check regulators along their length, which are used to divide the total length into two or three rotational segments. During the turn of a particular segment, the field staff maintains a certain level at the downstream regulator so that water can flow into all upstream branch canal turnouts. Again, no flow discharge and volume measurements are made for the branch canal service areas.

Groundwater

Organization

Groundwater development for agriculture is not new, but its organization in the Ministry is very new. In 1999, the Ministry established the Groundwater Sector in the Department of Irrigation, and a Groundwater Research Institute at the National Water Research Center. Previously, there was a small groundwater research office inside the Irrigation Sector that assessed groundwater availability and use.

At the field level, both the Groundwater Sector and the Research Institute have no presence in the form of staff at the district office. The Groundwater Research Institute investigates the potential for groundwater use and maintains inventory of how much is currently used, on a national level. The information is published in the form of Potentiality and Inventory Maps; the latest one is for year 2000. As such, the Institute seems to be a good planning resource for the Groundwater Sector. However, there is very limited field monitoring of how much groundwater is being actually used, and whether proper procedures are followed in its development.

Utilization

The groundwater for irrigation is being developed in two ways, through public and private sector. The Irrigation Department installs groundwater wells, usually in the downstream reaches of the branch canals, to relieve water shortage. These are larger pumps with an average design discharge of 350 m^3/hour. Farmers also install their private pumps, which are much smaller, with a design discharge of 25 to 50 L/s. The Ibrahimya District is planning to install ten new pumps, and the farmers have installed some 56 authorized and 61 unauthorized pumps. The S.Zifta has nine government pumps for the district and 148 government pumps for the whole Manofia Directorate. The General Director estimated 3000 unauthorized private pumps and 238 authorized pumps in the directorate service area.

Increased Use

Groundwater use for agriculture is projected to increase at fast pace, as farmers try to compensate for the reduced canal water supplies in the Delta. The Groundwater Sector has developed the policy for guiding public and private groundwater development, but it does not yet have staff at the district level. This is a serious deficiency that has resulted in operational problems including farmers facing difficulty in obtaining licenses, and the absence of monitoring of the groundwater use.

Concerns

Appropriate policy is in place to guide the utilization of groundwater, but the operational capacity is seriously deficient in the Ministry. The Groundwater Sector has no presence at the field level to guide the farmers in installing private wells. Private wells are being installed without proper licenses that are probably very cumbersome to obtain. The result is that the groundwater development is not properly monitored, both from water quantity and quality considerations.

Reuse of Drainage Water

Physical Facilities and Organization

The agricultural drainage system in the Delta, like irrigation system, is extensive; essentially all agricultural land is provided with subsurface pipe drains that discharge into a network of collector and main open drains. The Drainage Authority maintains all drainage facilities, including the collector pipe drains and the open conveyance drains. It is organized similar to the Irrigation Department, with separate budget and line of accountability to the Minister. At the field level, there is one drainage engineer at each district office.

Use by the Ministry

The Ministry of Water Resources uses drainage water by pumping it from the main drains to the main irrigation canals. Mixing of irrigation water with drainage water at the intermediate canal level is currently not practiced by the Ministry. In the Ibrahimya District, for example, three main drains collect subsurface drainage water and convey it to the outfall drain Bahr El-Saft (Fig. 3). El-Saft further drains into Bahr Hadus, wherefrom water is pumped into the El-Salam Canal.

Use by Farmers

Farmers, however, do pump from drains adjacent to their lands, especially in times of water shortage. They believe that the water quality is “not bad”, but the belief is not based on any measurements of the quality parameters. Even the very simple, but important, parameters such as salt content are not measured in the intermediate drains.

Monitoring of Drainage Water

The drainage engineer at the district office does not monitor water quantity and quality in any of the drains. They reported that the Drainage Research Institute does that periodically, at

locations where drainage water is pumped into main irrigation canals. The Drainage Research Institute confirmed that they monitor water quality in the main drains only, approximately 140 locations for the whole drainage system (Delta and Fayoum). Since 1992, they are following the new Water Quality Monitoring Program whereby some 31 parameters are monitored including salinity, BOD, heavy metals, odor, color and turbidity.

It seems that the main drains are well monitored for water quality, but the intermediate drains are not. In future, there is a proposal to mix drainage and irrigation water at the intermediate level, and then it will be necessary that the drain water quality be monitored at the local level.

Regional Laboratories

Each district, however, does not need to have the facilities to evaluate water quality parameters; a regional laboratory would be sufficient to serve many districts. In fact, a good laboratory already exists, and is located in the Drainage Authority Office in Zagazig. It is well staffed and equipped to evaluate soil and water properties including soil texture, soil and water salinity and pH, and BOD for drainage water. The lab is not used much presently, but can very well service the needs of the whole Eastern Delta Region.

Summary of Current Monitoring Practice at the District Level

Monitor Water Levels

At the district level, the present water monitoring system for the irrigation canals essentially measures water levels at key water delivery points. The idea is to maintain a certain water head at various delivery points so that water flows, by gravity, form main to branch canals and eventually to mesqas. Water level, therefore, is the critical information field staff needs to "operate" the system, not necessarily flow discharge and amounts. The practice, however, does not encourage efficient water use, which is possible when the system managers know how much water is supplied compared to crop water requirements.

Difficulties in Measuring Flow Discharge

There is another important reason why the engineers don't measure flow in the branch and mesqa canals. It is simply very difficult to measure flow in the zero-bed slope, low-level canals. The canals are essentially "long, narrow reservoirs" with very little flow that can be measured with reasonable accuracy. In general, the intake to the district and branch canals is the only place where flow can be measured, by using the orifice equation for the intake gates.

Monitoring for Drains and Groundwater

Similar observations are true for the drainage and groundwater use. Water quantity and quality is not measured in the intermediate drains and for the groundwater. It is measured in the main drains only, at locations where drainage water is pumped into main irrigation canals. These are periodic measurements that are made by the Drainage Research Institute, to determine how much drainage water can be mixed with fresh irrigation water. Similar to drainage water, groundwater monitoring is conducted periodically by the Groundwater Research Institute to access potential and actual use.

Review of Current Water Monitoring Practices at the Directorate Level

Water Allocation at Source

Each General Director, who heads a Directorate, supervises an average of eight districts (some 400,000 feddans service area). The General Directors are allocated their water share by the Water Distribution Center[3] on volumetric basis and that is how they receive it and manage it. The Water Management Section in each General Director's office is responsible for checking whether the Directorate is indeed receiving its share, by measuring flow discharge at specified locations. The Water Distribution Center resolves any disputes among directorates.

The Ibrahimiya irrigation district, for example, is under the West Sharkia General Director, who shares water with the East Sharkia Directorate on the Muis Canal (E.Sharkia 55% and W.Sharkia 45% of the flow). The flow measurement for the allocation occurs at the measuring station located at km 24, where the intake for Abu Alghadar canal for E.Sharkia is also located (Figure D-5). The intakes for Behnabai and Mashtool canals are located downstream at km 36. The General Director reported that his staff regularly measures the flow discharge, especially in summer. Often, the staffs from the two directorates and the Water Distribution Center jointly measure the flow discharge to avoid any allocation disputes.

Distribution Within Directorates

From the main canal, the General Director and the Inspectors then allocate water to the district canals; Mushtool and Behnabai for Ibrahimiya district, for example. The General Directors use information on crop water requirements, supplied by the Ministry of Agriculture, to estimate flow discharge for each canal. Gate settings are then calculated to deliver the required flow discharge in various district canals, based on orifice equation calibrations. The General Director then instructs the Inspectors and field staff to set the canal intake gates to deliver the required flow.

Operational Constraints

In practice, however, there is an operational problem. Most canal sections are very large, and the flow discharge, based on crop water requirements, may not produce the water surface level that is necessary to feed the branch canals. The field engineers said that since the canal sections are large, they probably put more water compared to what is needed to satisfy the crop water requirements. And, this is one reason why they monitor water levels rather than the flow discharge, since they cannot operate the system with flow discharges alone[4]. The water managers, therefore, may tell what ought to be the flow discharge in the district canals; not what actually is the flow discharge

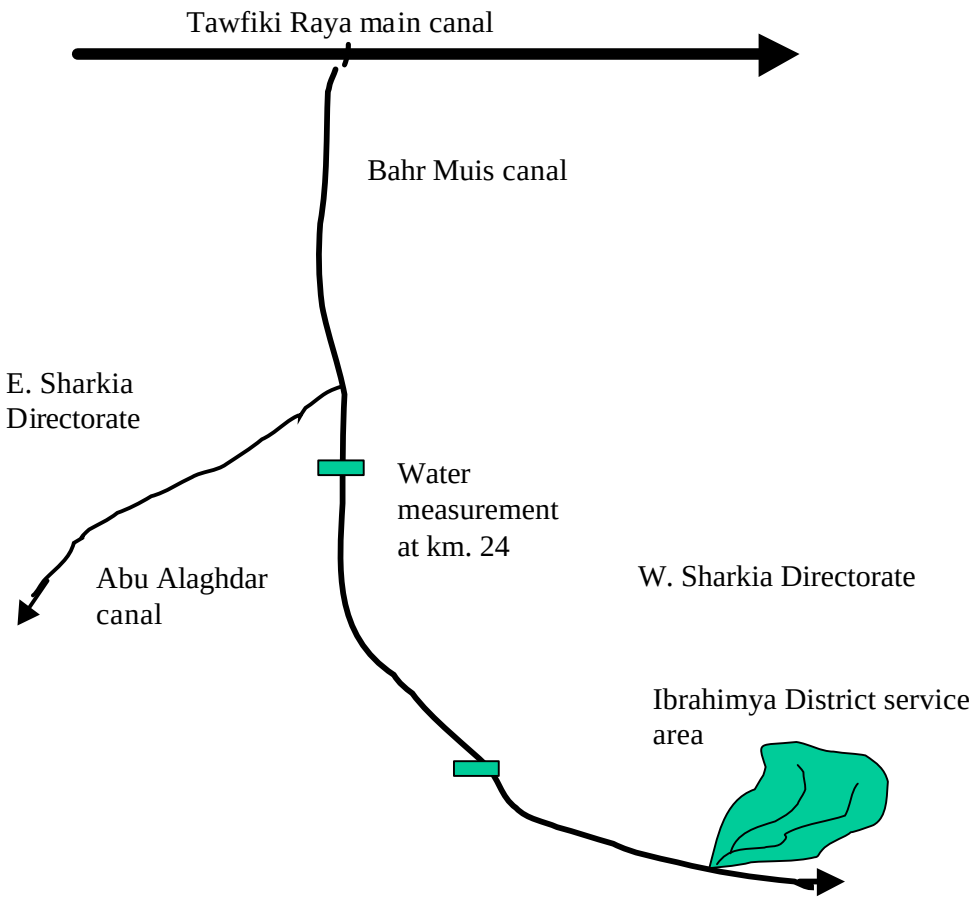
[3] For the Delta Region, the Water Distribution Center is located in Tanta. It is further supervised by the Central Water Distribution Directorate, which is located in the Ministry Office in Cairo.

[4] This is not entirely correct since the district canals are provided with check structures that are used to control the water level.

Strength and Weakness

In summary, water allocation and delivery in the main canals is on volumetric basis and flow discharge is monitored and measured to ensure equity and efficiency. However, past the main canal into the district canals, water is monitored for its surface level only. This is a universal response of operational engineers who must maintain appropriate energy head at key delivery points – form distributary to branch canals and from branch to mesqas. It does, however, seriously reduce their ability to properly "manage" water, in terms of efficiently matching irrigation water deliveries to crop water requirements.

Figure D-5. Water Allocation and Monitoring Among Directorates



Proposed Water Monitoring Program for IWMDs

Irrigation Water Monitoring Program

Justification

The existing practice of water monitoring does a reasonably good job of tracking water levels, since the district engineers need this information for properly operating the system. This practice is, however, not sufficient since it does not promote proper management. In future, a good measurement-based management will be needed to:

- Be consistent with the Ministry efforts to better match water supplies to demand, to save water for the expansion programs.
- Support future programs, including the Irrigation Management Transfer, where the district office will be responsible to deliver a given water amount to each branch canal.
- Be consistent with the water management efforts at the main system level, where water is allocated and delivered on volumetric basis.

Monitoring Parameters for Canal Water

It follows from the above discussion then that the district engineers need to manage their service area based on equity and efficiency considerations, combined with the operational concerns of maintaining a certain water level. They need to know crop water requirements and operational losses in their service area, so that they can match them with available water supply in an efficient way. This implies monitoring following parameters for the canal water.

- Flow discharge and water volumes entering the district service area,
- Flow discharge and water volumes delivered to the branch canals,
- Physical condition of canals and water surface levels, and
- Estimation of crop water requirements.

The information will help them identify problem areas, where excessive water is used compared to crop water requirements, and take appropriate remedial measures.

Monitoring Parameters for Groundwater

At macro level, the Groundwater Research Institute is taking appropriate first steps in collecting data such as:

- What is the potential for groundwater development in various regions? These are called the “potentiality maps”.
- How much groundwater is being presently pumped? Called the “inventory maps”.
- What is the government policy regarding groundwater use? Does it encourage or discourage groundwater use through private sector?

Micro Level Data

This information is off course necessary for macro planning, but does not tell much about what is actually happening at the field level, and how the district office can help farmers. The

district office needs to have qualified staff to properly monitor and guide farmers as they develop groundwater, through the private sector. The staff is also need for developing groundwater in the public sector. For proper evaluation and planning, it is necessary to know at least following data at the field level.

- Number of groundwater wells, public or private, average discharge, and relevant water quality parameters.
- How do water users get permits to install wells? Are they following specifications (spacing and depth, pumping rate, etc.)?

Drainage Water Monitoring Program

Current Monitoring

Some of the drainage water in the main drains is pumped and mixed with irrigation water at selected strategic locations. The mixing ratio is an important decision variable that depends on the quality of drainage and irrigation water. The mixing practice is being questioned, on the health grounds, as it is reported that the water quality in the main drains has progressively deteriorated. A suggested alternative is to mix water from intermediate drains to irrigation canals. The fundamental constraint is the lack of appropriate data on water quality of drainage water, both in the intermediate and main drains. Water quality is not measured on a regular basis – neither in the irrigation canals nor in the drains. The Drainage Research Institute periodically checks water quality in the main drains, and recommends the mixing ratio.[5]

Future Monitoring

Drainage water system should be monitored, especially for the purpose of evaluating its quality for reuse with irrigation water. Some relevant water quality parameters are following:

- Salt content (ppm or in terms of electric conductivity).
- Biological oxygen demand, BOD.
- Agricultural chemicals including nitrates.

Measurement of flow discharge in drains would be very difficulty, because of extremely flat energy gradient in the channels and the absence of control gates. Also, it is probably not useful to measure flow discharge within the district, since it is not pumped for reuse until the main drains. Drainage water is measured when pumped for reuse.

Method of Measurements

Canal Discharge Measurement

The proposed discharge measurement for district and branch canals can be easily accomplished by using orifice equation at the intake gates. The telemetry system already monitors water levels at the control gates, so the only additional information needed is the gate opening. The orifice flow equation will need to be calibrated (for coefficient of

[5] The Institute is a part of the Water Research Center, and is located at the Delta Barrage.

discharge) by measuring flow discharge with a flow meter. Appendix B explains the use of orifice equation for discharge measurement at the control gates.

Addition to the Existing Telemetry System

The existing telemetry program hardware and software is designed to accept the addition of data related to discharge measurement, specifically the gate opening (Figure D- 6). At the user end, the telemetry display actually shows gate opening and calculates discharge based on the orifice equation (currently, the gate opening can only be known by asking the gatekeeper). To know the gate opening through the telemetry system, appropriate sensor will need to be installed at the control gate to read the actual gate opening, and a control card in the data logger for transmitting the additional data.[6] Discussions with a local consulting company indicate that this is indeed possible, at a relatively low cost. Further investigations are recommended to estimate the cost, and possible implementation at few locations in the pilot IWMDs.

Figure D-6. Telemetry Station at the Intake of S.Zifta District Canals (ElAtf, ElSahel and ElKhadrwiya).

[6] The current telemetry program does not provide discharge at any of its locations, including the main canals. The main canal discharges, when reported, must be based on gate opening information provided by the gatekeeper. Perhaps, discharge measurement at the district level canals can be the first step towards adding this capability to the entire telemetry program.

Drainage Water Measurements

The water quality parameters of salt content (EC) and pH can be measured in the field using simple test kits. The test kits are simple to use and fairly inexpensive; an electrical conductivity meter, for example, can be purchased in about $ 50. For analysis of BOD, the water samples can be taken to the regional Drainage Authority laboratory (located in Zagaziag, for the East Delta Region). The staff, however, will need some training for proper collection and transportation of the water samples.

Groundwater Measurements

For the groundwater monitoring, some equipment will need to be purchased. This would include groundwater depth sensors, meters to measure pump discharge, and salt content of water (same EC meters as for canal water).

Key Locations for Monitoring

Canal Water

For reducing mismatch between water supplies and crop water requirements, it will be sufficient to monitor these parameters at the district levels; that is, at the intake of the district canals. As mentioned, this is the most convenient location for flow measurement since water levels at the control gates are already measured. Later, as the district engineers begin to appreciate and use this knowledge, the monitoring program can be extended to cover branch canal commands. Branch canals also have control gates, which can be calibrated to measure flow discharge. Staff gages are already provided to measure water levels; the only additional measurement needed is the gate opening.

The branch canal discharge monitoring will also be needed for the Irrigation Management Transfer program, which the Ministry is presently considering. In that program, management of irrigation facilities including mesqas and branch canals will be turned over to the farmers. It will then be necessary to know how much water is being supplied to each branch canal, for the sake of equitable water distribution among farmers and its efficient water use.

Drainage Water

Key locations for drainage water quality measurements will vary from district to district, depending upon where farmers currently pump for irrigation and future Ministry plans for use of intermediate drain water. The basic approach should be to monitor sample locations where drainage water goes from collectors to intermediate drains and from intermediate to main drains.

Program Implementation

Organization

Specific Unit at the District Level

A specific Planning and Water Monitoring Unit should assume responsibility for irrigation, drainage and ground water monitoring. Some of the reasons why this is desirable are following.

- Monitoring of irrigation and drainage systems fundamentally employs similar approach and expertise though parameters monitored may be different. It is, therefore, cost effective to combine the functions under one organizational unit.
- Monitoring and evaluation of water resource systems requires specialized expertise and tools, which can only be developed by targeted attention and focus.
- Monitoring and evaluation of system performance is for proper planning and management. It should, therefore, be viewed and implemented as an integral part of the planning function.

A somewhat similar unit already exists at the General Director's level, called the Water Monitoring Section. This proposal, for the district level, could be conceptualized as an extension of that function to the district level.

Roles and Responsibility

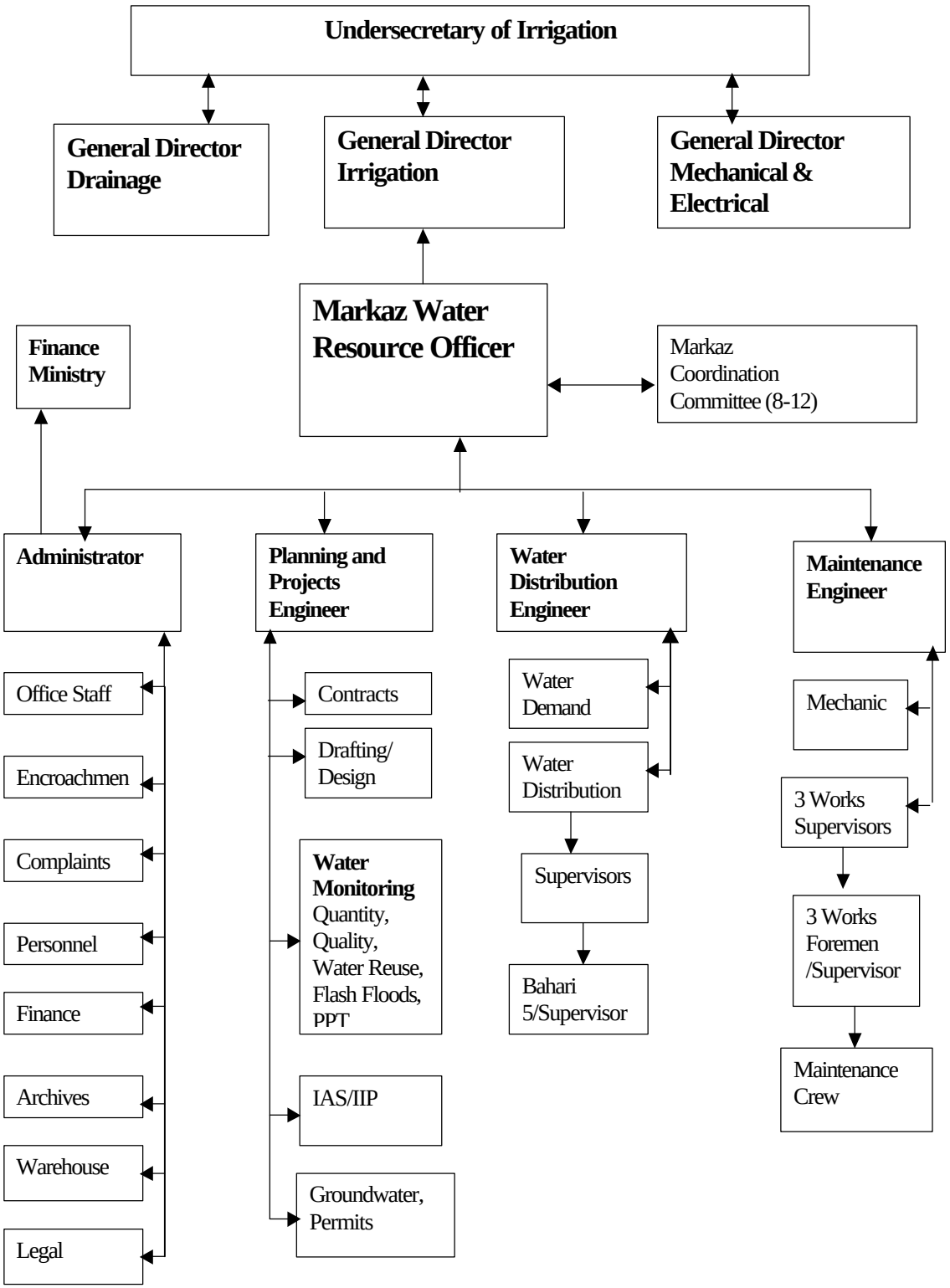
The Planning and Water Monitoring Unit will need to be staffed with one engineer, who will be in charge of the Unit, supported by appropriate number of technicians. The engineer will be responsible to the District Water Resource Officer[7], but will closely coordinate the unit's work, and share information, with other units of the Integrated Water Management District (Figure D-7: Organizational structure of IWMD). The Unit supervisor will also need to keep close contact with the Water Monitoring Section in the General Director's Office.

Parameters to be Monitored

In general, the Planning and Monitoring Unit will collect, evaluate and disseminate information that can enable the District better manage the irrigation and drainage system. The information on irrigation, drainage and groundwater needs to be evaluated in an integrated manner, so that issues are identified and resolved optimally. The required information will vary from region to region, but some basic management parameters are well known and are documented earlier in this report (Section 4, p. 13).

[7] Ken Mitchell has proposed the new title for the head of the future Integrated Water Management District, in his report related to the organization of IWMDs .

Figure D-7. Proposed Organization of Integrated Water Management Districts.



Resources Needed

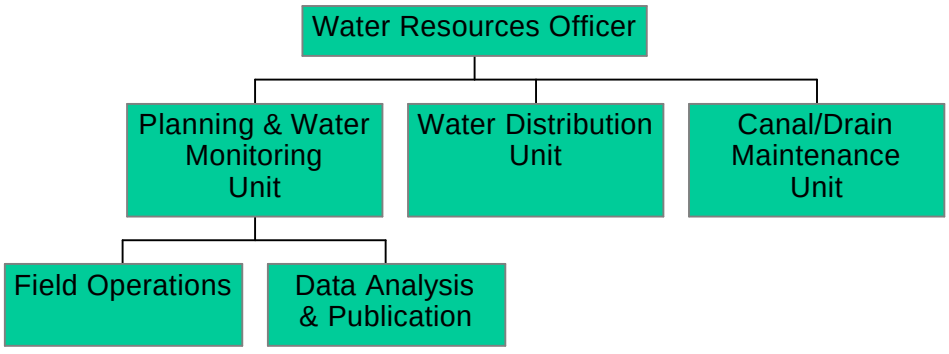
Staff

The Planning and Monitoring Unit needs to be staffed with at least one engineer, either from the Irrigation or the Drainage Sector. Experience in monitoring and evaluation of irrigation and drainage systems would be desirable, but probably not available. This concern will need to be addressed by appropriate training programs to strengthen expertise of the monitoring unit, and the district staff. The Monitoring Unit staff can be organized into two groups (Figure D-8):

1. Field operations group, who will be responsible for collecting all information including water measurements,
2. Data analysis and information group, who will be responsible for proper archiving and processing of field data and for publishing the findings.

The field operations group will need at least one technician and a number of field support staff. The field technician need not be a graduate level engineer. The data analysis group, however, will need a graduate level engineer with expertise in computer operations. The Unit may also need other support staff in the office, including one secretary/data archiving person.

Figure D-8. Organization of the Planning and Water Monitoring Unit.



Equipment for Flow Discharge Monitoring

To measure flow discharge at the district canal gates, appropriate hardware must be installed to measure the gate opening and then transmit the data through the existing telemetry system. An engineering consulting company[8], which specializes in measurements and controls, was of opinion that this is not difficult to do and should not be very expensive. One way to measure the vertical gate travel is to use mechanical-electrical sensor, and the other is based on photocell technology. The company engineers will make a site visit to Manoufia directorate to see the existing telemetry system, and then estimate the cost for the additional measurement and data transmittal.

[8] Technomedia Group, 27 ElMadena ElMonawara, Mohandeseen, Cairo. Tel. 336-6780.

A flow meter will be needed to calibrate the Orifice Equation for the canal intake gates. However, the equipment is expensive and will only be used for calibration (say once a year for each canal). It may, therefore, be sufficient to have two flow meters for the whole directorate office. The Water Monitoring Section in the directorate office can then help the district Monitoring Unit calibrate gates periodically.

Water Quality-Monitoring Equipment

For water quality measurements in irrigation and drainage canal, simple field kits are available, which are fairly inexpensive and easy to use. The Monitoring Unit should, at minimum, have the following field kits.

- Electrical conductivity meter, for testing salt-content of water,
- pH meter, and
- Field kits for Nitrogen content.[9]

As mentioned, the Drainage Authority has established regional laboratories that should be used (there is at least one in Zagazig). The laboratory can be used to check the accuracy of field kits, and analyze samples for more involved measurements such as BOD.

Groundwater Monitoring

The parameters that need equipment for monitoring are the groundwater depth and salt content. Other important information, such as the number of wells being installed and whether proper installation procedures are being followed, only needs proper implementation of licensing procedures. Perhaps, the licensing procedures need to be made simple so that the water users can easily follow these.

Capacity Building and Training

As indicated earlier, typical Ministry engineers lack the expertise and experience necessary for monitoring irrigation and drainage system performance. The district engineers are simply too busy with their current operational assignments. If there is a serious commitment to develop the culture of "measurement-based management", then the district level staff need to be increased in number and provided with proper training to strengthen their expertise. Ken Mitchell, in his organizational analysis, recommends that the IWMDs should have at least three engineers – one each for maintenance, water distribution, and planning and monitoring[10]. A Water Resources Officer will further coordinate and supervise the work of the three engineers.

Data Archiving, Analysis and Dissemination

Importance

One important outcome of a monitoring program is that the information related to the system performance is properly analyzed and used to improve the system performance. Towards this

[9] Hach, Inc. is one of several manufacturing company. Their website provides necessary information about their product line, prices and how to order (www.hach.com).

[10] Alternatively, the district units could be organized as: irrigation, drainage, groundwater, and planning and monitoring.

end, it is very important that appropriate procedures are in place to archive the field information, analyze the data and provide the information to the system managers and policy makers. Many monitoring programs lose their effectiveness because the field information is not properly analyzed and used as a real operational tool.

Responsibility

As recommended above, the responsibility for data analysis and dissemination should be clearly assigned to a specific staff group within the Planning and Monitoring Unit. The group leader should be graduate level engineer with experience and expertise in computer operations, monitoring and evaluation, data analysis and reporting of findings.

Information on District Canals

Information on flow discharge and water volumes for the district canals will be available at the General Director's office, since the telemetry terminals are only available at that office. It can be easily conveyed to the District offices through e-mail or telephone. It does mean, however, that the Monitoring Unit in the district office must have good computer with e-mail facilities.

The information on the amount of water supplied to the district canals on daily, weekly and monthly basis should be archived and published. The information becomes more meaningful, however, if it is combined with information on crop water requirements for the same service area. The system managers can then evaluate whether excessive amount of water is being supplied to the canals, and how the canal deliveries can be better matched to the demand. The Monitoring Unit can get the crop water requirements information from the Ministry of Agriculture district office.

Information on Branch Canals

Analysis of water supply and demand is also very beneficial for the branch canal service areas within a district. It can inform the system managers whether all branch canal service areas are receiving their fair share. The information will be critical for the Irrigation System Turnover program. However, the workload may be too much for the newly established Monitoring Units. It could be postponed initially and added later as the Unit gets more experience and expertise. Alternatively, few sample branch canals could be monitored – selected to represent the upstream, middle and downstream reaches of the district canal.

Information on Groundwater

The groundwater information should help the local managers (District Officers and General Directors) and the higher policy planners with following issues.

- How many wells are being installed, both private and government?
- Are proper procedures being followed?
- Are there any adverse effects on the long-term hydrology of the groundwater?
- What is the water quality? Is it suitable for agriculture? Is it suitable for human consumption?

Information on Drain Water

Most open drains in the delta appear to be heavily polluted with domestic and industrial discharges. There are increasing concerns whether farmers should continue to pump water from the intermediate drains. The Monitoring Unit should help the system managers with following information.

- What is the water quality in intermediate drains?
- How much of the drain water is being used by the farmers?
- Is the practice safe?
- What can be done to reduce pollution of intermediate drains?

Program Implementation in the Pilot Districts

The water monitoring program, and its implementation, recommended in this report is formulated with the pilot districts in mind. As such, all recommendations related to its organization in the district office, parameters to be monitored, and method of measurements, etc. are valid for the two pilot districts. The only helpful addition, without excessive repetition, will be to identify monitoring locations in the two districts, as following.

Ibrahimya District (Figure D-3)

Flow discharge will be measured at the intakes of Behnabai and Mahstool canals, which take water from Bahr Muis. The telemetry station here already reads the water levels, and the only additional measurement needed is the gate opening. The gate opening can be known by either asking the gate operator, or by making additions to the telemetry system described earlier in the report. After the arrangements are complete for the main canals, the flow monitoring can be extended to cover few branch canals (located in the upstream and downstream sections of the main canals). From the discharge measurements, water volumes supplied daily, weekly and monthly can be known. Information on cropping patterns and crop water requirements must be monitored in cooperation with the Ministry of Agriculture.

The drainage water in the open drains ElIqwa, ElMahmudiya, and ElIbrahimya should be monitored for quality parameters mentioned before. Until the staff is given the field testing kits, water samples can be taken to the Drainage Authority Laboratory in Zagazig for analysis.

For groundwater monitoring, efforts should be made to get one engineering staff appointed from the Groundwater Sector. The groundwater staff will then monitor the parameters listed in this report.

South Zifta District

Measure flow discharge in the three canals that supply water to the district service area – ElSahel, ElKhadrwiya, and ElAtf. The locations will be the check regulators that mark the district boundary from the upstream district (for example, check regulator at km.16 for the ElSahel canal). After these arrangements are completed, extend the flow measurement program to include few branch canals on each district canal. Estimate water volumes supplied to the district canals (and to branch canals) on daily, weekly and monthly basis, and compare with the crop water requirements.

For drainage water, monitor quality parameters in intermediate drains ElMansha, ElAtf and ElKhadrwiya. The water samples can be taken to the Drainage Authority Lab similar to one in Zagazig for analysis. For groundwater monitoring, efforts should first be made to get an appropriate staff member appointed at the district who can then take the monitoring responsibility.

Attachment A
Persons Contacted by Dr. Ramchand Oad

Ministry of Water Resources and Irrigation

1.	Eng. Ali Morsy	Head of Irrigation Department, Cairo
2.	Dr. Fatma Abd-El-Rahmen	Head, Groundwater Sector, Cairo
3.	Eng. Yehia Abdel Aziz	Water Boards, Cairo
4.	Eng. Essam Barakat	Head of Irrigation Advisory Service, Cairo
5.	Eng. Fauzi Ibrahim El Sobari	Undersecretary Irrigation, Gharbia,
6.	Eng. Abdel Meguid El Adalany	Undersecretary Irrigation, Menoufia
7.	Eng. Abdel Hamid Elgayyar	General Director for Irrigation, Menoufia
8.	Eng. M. Abdel Kawy Seliem	General Director of Drainage, Menoufia
9.	Eng. Mohamed Samir	Irrigation Inspector, Zifta Inspectorate
10.	Eng. Azza Abdel Hamid	District Engineer for Irrigation, Zifta
11.	Eng. Fatma Abdel Aziz	District Engineer for Drainage, Zifta
12.	Eng. Mohamed Elwarraki	Undersecretary Irrigation, Sharkia
13.	Eng. Abdel Rehim Nasr	General Director for Irrigation, West Sharkia
14.	Eng. Mohamed Shaalan	Undersecretary for Drainage, East Delta, Zagazig
15.	Eng. Ghoneim Abdel Meguid	General Director for Drainage, South Sharkia
16.	Dr. Khaled Wasif	Field Coordinator, Water Boards, Sharkia
17.	Eng. Abdel Latif El Said	Irrigation Inspector, Zagazig Inspectorate
18.	Eng. Abdel Fattah Elbaz	District Engineer for Irrigation, Ibrahimia
19.	Eng. Amanallah Farid	Director, Technical Office, C. Sharkia Directorate

Water Research Center

20.	Dr. Ahmed Khater	Director, Research Institute for Groundwater
21.	Dr. Abdel Khaliq	Deputy Director, Drainage Research Institute

WPAU

22.	Eng. Sarwat Fahmy	Co-Task Manager
23.	Eng. Mohamed Hamed	Engineer

Consulting Engineers

24.	Dr. Mohamed Hussein Nabil	Executive Manager, Technomedia Group, Cairo
25.	Eng. Islam Shaheen	Technomedia Group, Cairo

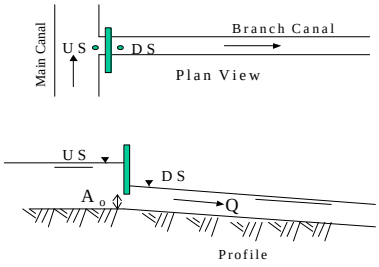
EPIQ

26.	Dr. Larry King	Co-Task Manager, Senior Irrigation Engineer
27.	Dr. Ibrahim Elassiouty	Water Resource Management Specialist
28.	Dr. Ragab Abdel Azim	Irrigation Engineer
29.	Dr. Kenneth Mitchell	Irrigation District Management Specialist
30.	Dr. Marshall English	Irrigation Scheduling Specialist

Attachment B
Flow Measurement at Intake Gates
Using Orifice Equation

The orifice flow equation is written on the following format:

$$Q = C_d A_o (2g)^{0.5} (H)^{0.5}$$



Where $H = US - DS$,
A_o = Area of gate opening = $d \times b$, where d is opening in meters and b is the gate width.

Q is the orifice flow (m^3/s), g is the acceleration of gravity = 9.81 m/s, and C_d is the discharge coefficient which varies from 0.58 to 0.62.

Linrearization of the above equation and rearrangement of the constants produce the following linear equation:

$$\frac{Q}{\sqrt{H}} = C \times d \pm L$$

Then, the constants C & L are determined from the best fitting of the line between $Q/(H)^{0.5}$ and the gate opening (d).

Attachment C
Field Notes
Ibrahimya Irrigation District in Sharkia

General
7.1
The Ibrahimiya Irrigation District is located northeast of Cairo, in the Sharqiya Governorate. It is under the administration of the General Director for Irrigation, located in Zagazig. An irrigation engineer is the head of the District Office (Engr. Abdel Fatah, and coordinates work with an engineer for Drainage (Engr. Ibrahim). Offices of the relevant Inspector and General Director are located in the main Irrigation Ministry building in Zagazig.

Existing Irrigation Water Monitoring Practices at the District Level[11]

Canal Water

The district receives irrigation water from two canals: Mashtool and Behanbai that take water from the main canal Muis, which receives water from the Taufiq Raya canal originating at the Delta Barrage. All service area of Behanbai canal is within the district, whereas the Mushtool canal irrigates lands in Ibrahimiya and in the downstream district of Kafr-Sakr . The canal service areas are as follows.

- Behanbai 20,000 feddans
- Mushtool 30,000 feddans in Ibrahmiyia
  10,600 feddans in Kafr-Sakr
- Muis gehanbiya 7,800 feddans.

Total district service area = 57,800 feddans[12]

The district canals have flow regulation gates at the intake, where both upstream and downstream water levels are read through the telemetry program. However, the flow discharge is not measured and monitored at this level, which could be easily done if the control gate opening was regularly monitored. As mentioned, the telemetry software and hardware is designed to permit this addition. The district receives its quota or share of water at these control points, which are important locations for future flow monitoring and measurement program.

Groundwater

The district is installing ten new groundwater pumping stations, to relieve water shortage in some of the branch canals. Design discharge of these pumps is 350 m^3/hour. Farmers also install their private pumps, which are much smaller, with a design discharge of 25 to 50 L/s. There are close to 76 permitted private groundwater pumps and some 60 unauthorized pumps.

[11] This report is based on information gathered during a field trip to the Ibrahimya District on July 16-17. Subsequent to the field trip, further discussions were held at the IWMD Workshop in Port Said (July18-20).
[12] The District Engineer mentioned the service area to be 59,000 ha.

Reuse of Drain Water

There are three main drains that collect subsurface drainage water from the tile drains and convey it to the outfall drain Bahr El-Saft. El-Saft further drains into Bahr Hadus, where from water is pumped into the El-Salam Canal. There is no mixing of fresh irrigation water with drainage water within the district service area, though many farmers do pump from open drains.

Monitoring Drainage Water

The drainage engineer at the district office does not monitor water quantity and quality in any of the drains. They reported that the Drainage Research Institute does that periodically, at locations where drainage water is pumped into main irrigation canals. However, there is a future proposal to mix drainage and irrigation water at the intermediate level, and then it will be desirable that the drain water quality be monitored at the local level. Each district, however, does not need to have the facilities to evaluate water quality parameters; a regional laboratory would be sufficient to serve many districts. In fact, a good laboratory already exists, which is located in the Drainage Authority Office in Zagazig. It is well staffed and equipped to evaluate soil and water properties including soil texture, soil and water salinity and pH, and BOD for drainage water. The lab is not used at all presently, but can very well service the needs of the whole Eastern Delta Region.

Water Delivery to Farmers

Water delivery to the farmers on Behanbai canal is a three-turn rotation:

- Intake to km 8: 5 days on followed by 10 days off
- Km 8 to end: 5 days on followed by 10 days off
- In the third five-day period: water is shutoff in the whole canal.

On Mashtool canal, there is a two-turn rotation:

- Intake to middle: 5 days on followed by 5 days off
- Middle to end of district 5 days on followed by 5 days off.

The Mashtool farmers receive more water since they cultivate more rice. The District Engineer and his staff monitor water levels at the check regulators in the main canal for assessing water sufficiency. They maintain a certain level at the regulators so that water can flow into all upstream branch canal turnouts. No flow discharge measurements are made in any of the district irrigation/ drainage canals.

Monitoring Practice

The present water monitoring system, therefore, essentially measures water levels at key water delivery points. The practice is quite logical since by maintaining a certain water head at various delivery points, the operational staff make certain that water flows, by gravity, form main to branch canals and eventually to mesqas. Water level in the branch canals and mesqas is normally lower than the land, and farmers must pump it to their land. Water level, therefore, is the critical information field staff needs to “operate” the system, not necessarily flow discharge.

Existing Irrigation Water Monitoring Practices at the Directorate Level

Water Aallocation at Source

The Ibrahimiya Irrigation District is under the General Director, West Sharkia Directorate, which shares water with the East Sharkia Directorate on the Muis Canal (E.Sharkia 55% and W.Sharkia 45% of the flow). The flow measurement for the allocation occurs at the measuring station located at km 24, where the intake for Abu Alghadar canal for E.Sharkia is also located. The intakes for Behnabai and Mashtool canals are located downstream at km 36. Each directorte, therefore, is allocated its water share on volumetric basis and that is how they receive it and manage it.

The Water Management Section in the General Director's office periodically checks the discharges by using current meter measurements. The Water Distribution Center (in Tanta) overseas the allocation among all directorates and resolves any disputes by periodic flow measurements. However, when water flows further into the district service areas, system operation is by water levels and not water amount.

Distribution Within Directorate

From the main canal, the General Director then allocates water to the two Ibrahimiya district canals. The information on crop water requirements is used as a basis for the water allocation, which is supplied by the Ministry of Agriculture. The General Director then instructs the inspectors and field staff to set the district canal intake gates to deliver the required flow. The incoming flow in the canal then results in a water surface level, which is then tracked by the inspector and district engineers to operate rest of the system described above.

Attachment D
Field Notes
South Zifta Irrigation District in Menoufia

General

The South Zifta Irrigation District is located northeast of Cairo, in the Manofia Governorate. It is under the administration of the General Director for Irrigation, Manofia. There are two Inspectors and 11 District Engineers in the Manofia General Directorate. An irrigation engineer is the head of the District Office (Engr. Azza Abdul Hamid), and coordinates work with an engineer for Drainage (Engr. Fatma Abdul Aziz). Office of the relevant Zifta Inspector (Engr. Mohamed Samir) is also located in the same building.

Existing Irrigation Water Monitoring Practices at the District Level[13]

Water Source

The district receives irrigation water from three canals: El-Atf, El-Khadrawiya, and El-Sahel that take water from the main El-Manofi canal, which originates at the Delta Barrage. The District service area is located at the north tail end of these canals, and any excess canal water eventually drains into the main Qarenein Drain. Part of the drain water is pumped into the main Abbasi Rayah irrigation canal at the East Manofia pumping station. A check regulator structure in each canal marks the boundary between S.Zifta and its upstream neighboring district. The district receives its quota or share of water at these control points, which are important locations for future flow monitoring and measurement program.

Water Delivery

The district receives water in the three canals on a turn basis, which in summer is 5 days on followed by 10 days off. During a particular on-turn for the District, all flow in the canal is available for use in the district service area. The district water share is monitored by reading the water level upstream of the regulator gates that mark the district boundary. That is, the Inspector delivers water to the District Engineer at a certain level at the first regulator. Flow discharge and water volume supplied to the district are not monitored and measured.

Distribution Among Users

Within the district service area, farmers on branch canals receive water from the main canal on a similar 5-days on and 10-days off turn. The main canal length is divided into three rotational areas, with water going to each area for 5 days followed by ten days closure. Check regulators with gates are used to implement the water rotation. The district engineer's field staff tries to maintain a certain level at the regulators so that water can flow into all upstream branch canal turnouts. Again, flow discharge and water volume entering into branch canals are not monitored and measured.

[13] This report is based on information gathered during a field trip to the South Zifta District on July 10-12. Subsequent to the field trip, further discussions were held at the IWMD Workshop in Port Said (July18-20).

Monitoring Practice

The present water monitoring system, therefore, essentially measures water levels at key water delivery points. The practice is quite logical since by maintaining a certain water head at various delivery points, the operational staff make certain that water flows, by gravity, form main to branch canals and eventually to mesqas. Water level in the branch canals and mesqas is normally lower than the land, and farmers must pump it to their land. Water level, therefore, is the critical information field staff needs to "operate" the system, not necessarily flow discharge.

Ground Water Use for Irrigation

The district engineer reported that there are nine pumps, which pump groundwater at an average rate of 350 m^3/hour. The pumps are installed by the Irrigation Ministry, usually in the downstream reaches of the branch canals, to reduce water shortages. The whole directorate has 148 such pumps. In addition to the government pumps, farmers also install private groundwater pumps that are relatively of smaller capacity (average 60 m^3/hour). The General Director (Manofia) reported that there are approximately 238 permitted farmers' pump and some 3000 unauthorized pumps.

The General Director for Groundwater (in Tanta) raised several concerns. He stressed the necessity of monitoring the number of wells being installed, their average pumping rate, and whether the pump installation and groundwater use is according to prescribed regulations. Both quantity and quality of groundwater use is not systematically monitored, even though the groundwater use is increasing at a fast rate. Country-wide estimates put the current groundwater use at 4 billion m^3/year, which is projected to increase to 7 billion m^3/year by 2017.

Existing Irrigation Water Monitoring Practices at the Directorate Level

Water Allocation at Source

The Manofia General Director receives water quota on the Manofi canal in terms of volume per day. The Manofi canal discharge is measured at the Delta Barrage, and the Water Distribution Center (in Tanta) then allocates volumetric shares for each Directorate. The Manofia General Director is therefore responsible for receiving a given flow, taking the Directorate share and delivering the rest to the downstream governorate (Gharbia, in this case). The measurements are made at specified locations along the main canal. The telemetry system gives data on water levels upstream and downstream of the control gates and the gate openings are read manually. Orifice equation is then used to know the flow discharge. The Water Management Section in the General Director's office periodically checks the discharges by using current meter measurements. In addition to flow measurements at the control gates, main canals are provided with flow measuring weirs at critical water allocation points.

Distribution Within Directorate

From the main canal, the General Director then allocates water to the three Zifta district canals. He uses information on crop water requirements for the canal service areas as a basis for the water allocation, which he gets from the Ministry of Agriculture. He then instructs the

inspectors and field staff to set the district canal intake gates to deliver the required flow. The incoming flow in the canal then results in a water surface level, which is then tracked by the inspector and district engineers to operate rest of the system described above.

Appendix E

Function

and

Organization

of an

Integrated

Water Management District

Dr. Kenneth C. Mitchell
August 2001

Contents of Appendix E

Executive Summary

The EPIQ Water Policy Reform Program (Contract PCE-I-00-96-00002-00, Task Order 807) is charged with advising and providing technical assistance to the Ministry of Water Resources and Irrigation (MWRI) of the Government of Egypt (GOE) with respect to improved policy assessment and planning, improved irrigation system management, and improved private sector participation in policy reform. The EPIQ program is part of the USAID Agricultural Policy Reform Program (APRP). EPIQ Team members are currently implementing work plan activities related to the Tranche V Benchmarks.

Tranche V Benchmark C.l involves decentralizing water management and focuses on integrating all water management functions at the district level. An integrated water management district would provide an integrated package of services and practices including irrigation, drainage, conjunctive water utilization, rainfall management and flood control. Globally, it is widely accepted that water management policies can be made more effective by directing the level of operation to localized coordination entities. It is also accepted that water management policies can be made more effective by directing the level of operation to localized coordination entities. Under present operational and administrative conditions, the management of supplies and services within MWRI is handled through line department directives and functions emanating from the central ministry to lower line offices at the inspectorate and district levels. Usually there is limited coordination or communication in the planning and delivery of services and supplies, or consolidation and sharing of resources, at these levels. As a result, the District Engineer focuses solely on irrigation issues, and has little or no management coordination authority to integrate the other aspects of delivery and use, i.e., drainage, groundwater and rainfall, water quality, mechanical equipment, maintenance, improvements, or financing. The impetus for this policy reform is to initiate such a program in Egypt by decentralizing water management and focusing on integrated district level coordination and management.

Organizationally, the management of water resources is a separated, fragmented authority line that does not allow the integration of all the water resources available to the nation. The organization of the Departments and Authorities is primarily controlled at the Directorate level with very limited delegated authority at the district level. The district engineers do not have a delegation chart to allow them to depend on others to be responsible for operations.

The organization envisioned with this report is a drastic change from the existing organization in decentralizing the management and allowing the managers on a lower level to manage their budgets and irrigation and drainage operations. The Directorate will have a different role - that of ensuring maintenance on the main canals, overseeing maintenance and operation in the district and requesting water for the individual districts. The Directorate will have authority to inspect the operations of the district and make recommendations to the Central Ministry.

The district as envisioned with this report is seen as an area of between 40,000 feddans and 60,000 feddans with the added responsibility of the Official as having responsibility over three districts of responsibility (irrigation, drainage, mechanical/electrical). However, the important issue is that the decision making process is decentralized to allow those actually performing the inspection and control of the canals to also have control of the associated

budgets. The district as envisioned could actually be an Inspectorate with 180,000 feddans but the Official must be able to manage all of the issues. A major problem with having a larger district is the limitation of representation by the water users on the Board of Directors.

The primary obstacle to effective water utilization in Egypt at the district level is the lack of equipment and materials for improving the system of district canals. There are sufficient personnel numbers, although there is a shortage of qualified technical staff in each district to perform the required functions or there is the lack of training the available staff. There are no equipment or materials even for painting the offices. The district responsibilities are divided between the Irrigation, Drainage, and the Mechanical Electrical Departments. There is no formal organization for the different entities to communicate or work together even though in many instances coordination is satisfactory. Because there are three distinct organizations, with identical administrative organizations there is much redundancy and wasted effort with individual organizations. Many of the staff is under utilized because there are no materials for them to improve the canal and perform their jobs.

An Integrated Water Management District (IWMD) should be formed with ministry policies sufficient to provide the authority to manage all the water resources of the district area. The manager of this IMWD has much greater responsibilities than any of the existing district engineers and his/her position should probably be at the same level as an Inspector. The title of this manager could be "District Water Resources Officer", identifying the fact that he/she is responsible for all of the water resources of the district and that he /she supervises other engineers. The most important recommendation is that the officer also has control of a budget.

General Recommendations

The following are recommendations of items that need to be addressed in organizing the IWMD with the District Water Resources Officer:

1. Provide for a delegation of authority to manage district resources.

2. The officer should delegate authority to his supervisors or supervisory engineers to organize their staff to be most effective for their management. This includes the ability to redistribute positions if necessary and personally train and coach individuals under their responsibility.

3. Each supervisor should be responsible for training staff in their duties.

4. Provide a budget for the officer from existing Directorate funding for operation maintenance and salaries. Savings in salaries should be used in maintenance.

5. Recommend that the investment portion of the budget be used to purchase an excavator, drain washers, transportation, wagons, ditcher, tools and other equipment required to adequately maintain the facilities. The district should also budget for replacement of that equipment.

6. Recommend that the maintenance portion of the budget be used to purchase maintenance materials and contract with small private entities as required for maintaining the canals.

7. Water should be distributed equally among all of the branch canals.

8. Water should be measured at each branch canal to ensure equitable distribution. This measurement initially could be by gate rating curves. Each district should purchase their own measurement set with transportation to measure canals regularly.

9. Each district should provide for water sample collection for analyzing water qualities, quantities and depths in the canals, drains and groundwater and monitoring quantities withdrawn for irrigation.

10. Alternative sources of water such as groundwater, drainage reuse and effective precipitation should be used as much as possible to supplement Nile River water. The IWMD Official and his staff in coordination with higher-level authorities within the Ministry of Water Resources and Irrigation should assess these sources and decide how these resources contribute to meeting a part of the water requirements of the district.

11. A goal of reusing 1 million cubic meters per 1000 feddans per year should be used in those districts where drainage water is reusable. The reuse pumping plants should all be similar small plants (package plants) that could supplement branch canal water needs. A spare pump should be installed at each plant for operation rotation and for water shortages. Pump usage should be continuous during the branch canal rotation. Excess water supply from the Nile would result in shutting off the pumps. These small pumping plants would best be served by an electrical supply source if possible.

12. Those districts where groundwater is available should set goals for groundwater utilization by private development of wells. Groundwater should not be considered a district responsibility. Use of groundwater as a continuous supply should be encouraged as much as possible. Groundwater can play a huge role in meeting the municipal and industrial requirements as long as it is protected to produce good water quality. The district should monitor annual use from the groundwater pumps within the district boundaries and ensure groundwater protection.

13. Canal and drain maintenance should be by district staff with limited contracting to small private companies.

14. Equipment maintenance should be by district staff unless there is not sufficient work to keep the employee busy constantly. Maintenance that cannot be performed by staff should be performed by local mechanics. Preventative maintenance of the equipment is still the responsibility of the district and needs to be budgeted.

15. A ditcher and several heavy chains should be purchased for cleaning the canal.

16. Canals should be dredged only as needed to provide design sections. Banks should be trimmed using a ditcher to dress the canal banks and clean out grass.

17. Washer machines should be used to flush collector drains at least once per year. This work should be transferred to the benefited landowners as soon as possible.

18. When the washers are not in use, tractors should be used to pull the ditcher and for other construction work on the canals and drains.

19. One or two construction wagons should be purchased to provide material transportation to work sites.

20. Canals and drains should be cleaned to ensure good flow of water to and away from the farms.

21. The district should monitor water quality and communicate the results to the residents of the branch canals and drains.

22. A Coordination Committee for the district should be formed with a primary purpose to communicate more effectively with the water users. Monthly meetings should be held in the locations rotated throughout the district to provide more access and information to the water users on district activities.

23. District should be an organizing catalyst in obtaining a fenced solid waste disposal area for each branch canal or community.

24. The district should encourage some form of sewage treatment for each community by utilizing the threat of violations of the dumping laws. Most small communities could consider a sewage lagoon with a deep anaerobic pit for decomposition of the solid wastes. This would not require excessive area or cost and would not be a public nuisance but would need to be fenced.

25. Districts should be formulated as much as possible to be responsible for a command area so that water is delivered to the head of a canal by the Directorate and the district is responsible for the area. South Zifta is a district that probably should be expanded to include the head of the two canals that deliver water to the branch canals.

Integrated Water Management District Overview

Responsibilities

- Maintenance of All Branch Canals
- Maintenance of All Open Drains Within District
- Maintenance of All Collector Drains
- Operation and maintenance of All small pumping stations
- Development of an annual budget
- Distribution of Water
- Support for the distribution of water and facilities maintenance
- Development of water reuse plan within irrigation district
- Monitor water qualities and quantities of canals and drains within the district boundaries.

Underlying Assumptions

- Each Irrigation District will be different although similar
- Irrigation District is totally responsible for water and drainage from the branch canal.
- Drainage Authority is for design, implementation and rehabilitation of projects

- Mechanical & Electrical Department is for design and implementation of pumping plants. The irrigation district maintains small pump stations with major pump stations maintained by the Department.
- Groundwater and drainage water is available for part of the district water supply.

Recommendations

- Each District should make an annual budget.
- Each district should budget from their investment
- An excavator
- Adequate transportation (Autos and motor scooters)
- Each district should maintain two washer machines with tractors. During washer non-use periods, the tractors should be used in maintenance of the drains and canals.
- Each district should have a ditcher that could be pulled by the tractors for cleaning canal and drain banks.
- Each district should provide pumping stations for drainage water reuse within MWRI policy.
- Each district should encourage private groundwater development for shortages within the policies of the Groundwater Sector.

Introduction

Background

The EPIQ Water Policy Reform Program (Contract PCE-I-00-96-00002-00, Task Order 807) is charged with advising and providing technical assistance to the Ministry of Water Resources and Irrigation (MWRI) of the Government of Egypt (GOE) with respect to improved policy assessment and planning, improved irrigation system management, and improved private sector participation in policy reform. The EPIQ program is part of the USAID Agricultural Policy Reform Program (APRP). EPIQ Team members are currently implementing work plan activities related to the Tranche V Benchmarks.

Tranche V Benchmark C.l involves decentralizing water management and focuses on integrating all water management functions at the district level. An integrated water management district would provide an integrated package of services and practices including irrigation, drainage, conjunctive water utilization, rainfall management and flood control. Globally, it is widely accepted that water management policies can be made more effective by directing the level of operation to localized coordination entities. It is also accepted that water management policies can be made more effective by directing the level of operation to localized coordination entities. The objective of this study has been to initiate such a program in Egypt by decentralizing water management and focusing on integrated district level coordination and management.

Decentralized management is not a new concept for the water resources sector in Egypt. A study during the 1990s conducted by the office of the Minister recognized the "model irrigation district" as a means of testing decentralized management and authority at the local level, and consolidating operations and management of water resources at the district level. In addition, participation of the water users has been at the center of a movement leading toward increased local private sector water management. The Irrigation Improvement Project, started by USAID in 1989, established a pattern of tertiary-level system transfer to water users. More recently, policy reforms under the APRP program are leading toward private sector involvement in secondary level system O&M through Branch Canal Water User Associations. The associations allow for initiation of other donor-assisted projects in this area. Most recently, also under APRP sponsorship, a policy reform and pilot program in irrigation management transfer to water users and the private sector was undertaken. These are all efforts in privatization and are leading toward progressive decentralization and localized management of water resources that are expected to increase agricultural production per unit of Nile system water.

Despite the progress noted above, the concept of district level integrated water management has yet to be introduced in Egypt, although it is now a major feature in many other countries. These countries, among the most successful examples being Mexico, USA, France, Spain, and the Netherlands, have demonstrated satisfactory experience in using this means of local water management. The MWRI has a long-term goal to reorganize its internal functions and operations through a process of local consolidation and ministry-wide decentralization, including devolution of authority to the local level. This benchmark supports this goal and its successful implementation will mark a major turning point for the decentralization process to be introduced in Egypt.

Under present operational and administrative conditions, the management of supplies and services within the MWRI is handled through line department directives and functions emanating from the central ministry to lower line offices at the inspectorate and district levels. Usually there is limited coordination or communication in the planning and delivery of services and supplies, or consolidation and sharing of resources, at these levels. As a result, the District Engineer focuses solely on irrigation issues, and has little or no management coordination authority to integrate the other aspects of delivery and use, i.e., drainage, groundwater and rainfall, water quality, mechanical equipment, maintenance, improvements, and financing. The impetus for this policy reform, therefore, is to: (a) develop a strategy and procedure for decentralizing services and delivery, (b) improve and focus district level operations to remove costly inefficiencies and redundancies, and (c) provide greater flexibility and control to technical service providers and cultivators at the district level.

Experience in the Dominican Republic with water users associations showed that an original 25,000 acre project prior to implementation was able to only irrigate 12,000 acres with the remaining project acres affected by water logging and salinity but after the initiation of the associations of farmers, the entire 25,000 acres was brought into production. The associations of farmers were able to modify operations sufficiently that there was equitable distribution of water, excess irrigation was reduced considerably, and therefore waterlogging and salinity problems were eliminated or reduced.

In every international water management experience, an effective Water User Organization has been part of a successful integration of all the water resources of an irrigation district. Egypt has had experience with WUAs on a mesqa level and is beginning to implement WUAs on branch canals. However, WUAs as presently viewed with the number of people required would be impossible to manage and receive effective guidance. The WUA or Board of Directors should be a small group of not more than 12 with the district engineer as a ministry representative. It would review budgets and plans and request changes to management policies. Only water users should be on the Board because the purpose of the board is to advise the district on water management and canal and drain maintenance. The Board should interface with Water Boards but the purpose of the Board of Directors is for serving the water users.

Policy Issues and Reform Objectives

- Lack of integrated water management at the district level in Egypt is restricting the ability of the MWRI to make the most efficient use of water from all sources. The greatest production per unit of water is unobtainable without integrating all sources of water into district-level management decisions.
- Centralized water management decisions do not always allow timely adjustments of water deliveries to and within the districts.
- It is not clear if the existing legal framework governing water and water management allows for all administrative and operational reforms encompassed by this benchmark.
- The objectives of this policy reform are to overcome these policy issues by moving toward the goal of reorganization of MWRI internal functions and operations including devolution of authority to the local level thereby decentralizing water management and eliminating district-level inefficiencies and redundancies.

Expected Effects

- Improved institutional and physical efficiencies through effectively integrating physical, institutional, and service aspects of water management at the district level leading to increased agricultural production per unit of Nile system water.
- Sustained coordinated stakeholder involvement directly in water management and agricultural planning.
- Decentralized water management decision-making to the local level will insure more sustainable water resource utilization throughout Egypt.
- Improved functional coordination at the local level including water allocation and distribution, drainage, and physical operation/ maintenance within the district should increase potential for agricultural export growth and contribute to growth of Egyptian GDP as well as an accelerated shift to higher value crops for export.
- Provide guidelines to MWRI for planning the institutional reorganization and decentralization of the ministry.

Study Process

Data was collected for this report from June 13 through August 1 to identify a method to organize an irrigation district (model District) that would cover all aspects of the issues and the organizations that will be affected by this decentralization effort. The following is the steps that were undertaken:

1. Review the current organizational structure of water management at the district level for different departments such as irrigation, drainage, mechanical, and electrical, groundwater, water distribution, channel maintenance, Irrigation Advisory Service, Nile Protection,
2. Assess the strengths and weaknesses of the existing district organizational structures and their impact on the water management efficiency.
3. Identify the key constraints to efficient use of water from all available sources in the pilot IWM districts.
4. Recommend a suitable organizational structure for the district in order to cope with the proposed integrated water management approach(s) and to insure its (their) sustainability. This structure must include linkages and relationships between central irrigation management and the IWMD. The roles and responsibilities associated with the proposed structure as well as the extent and nature of the decentralization process should be addressed.
5. Prepare a report evaluating the present organizational structure at the district level and containing recommendations for the best organizational structure and an operational plan for the pilot IWM districts and deliver this report to the EPIQ co-task manager for the IWMD benchmark.

Existing Water Management in Egypt

Management of water resources in Egypt on an individual irrigation district is now covered in three sectors with different lines of accountability to the Minister of Water Resources and Irrigation. The three primary sectors are: Irrigation Department, Drainage Authority, and Mechanical and Electrical Department. The Irrigation Department is responsible for distributing the water and maintaining the canals, the Drainage Authority is responsible for maintaining the drains, and the Mechanical and Electrical Department is responsible for operating and maintaining any pumps and mechanical facilities for drainage reuse and groundwater utilization. All affect the delivery of water to the water users and maintenance of the continued arability of the irrigated lands.

There are other organizations that deal directly or should deal directly with issues at the local level in addition to the three main functions. Correcting problems at the local level can easily provide solutions to problems on a national scale. The organizations or considerations that need to be addressed in the formation of an Integrated Water Management District are the following: 1) Groundwater affecting both use and reuse, deep groundwater as well as shallow groundwater; 2) Precipitation allocation where there is the potential for using precipitation more effectively; 3) Flash flooding where this affects the operation of irrigated lands; 4) Irrigation Improvement Project (IIP) with the associated Irrigation Advisory Service (IAS) where these are in place or when they are incorporated into district operations; 5) Environment/water quality should be included to respond in each district; 6) Nile protection in regards to weed control and bank stabilization should be included in those districts that abut the Nile or one of the branches. The following table illustrates the concerns that should exist at the district level:

District Interest Chart

Nile Protection	Environment/ Water quality	IIP/IAS	Irrigation Delivery	Drainage	Groundwater	Mechanical
Rainfall	Water Measurement	Floods	Telemetry	Survey	Preventative Maintenance	Canal Maintenance

The organization of the Departments and Authorities manage most at the Directorate level with a limited delegated responsibility at the district level. The district engineers do not have a delegation chart to allow them to depend on others to be responsible for operations. Integrated Water Management Districts should be organized in the Oasis and any other areas where alternative water supplies are used.

Irrigation Department/Irrigation Sector

The Irrigation Department has a centralized organization with and irrigation sector that authorizes activities in each Directorate. The General Director of Irrigation at the Directorate collects all information regarding budgeting and prepares a budget for the entire Directorate without identifying the specific use of the funds in districts except that they are categorized into three main groupings. Informally he probably determines the budgeting for each district but it is not a formal determination. The following are the three main groupings:

1. Salaries, dependent upon personnel in the Directorate;
2. Maintenance, materials for maintaining the works in the Directorate, generally based on specific projects outlined and requested by the District Engineers, generally performed by contractors;
3. Investment - rehabilitation and improvements based on specific projects, generally performed by contractors.

As can be seen, there is not a budget for materials for use of irrigation staff. None of the District Engineers has control of what is actually authorized for that district. In addition the districts do not have control to purchase even minor materials for maintenance that district personnel could perform.

Directorates in Egypt are organized to direct the efforts of the individual districts and serve up to 500,000 feddans. The Directorate is headed by a Director that is responsible for most of the decisions in his Directorate. This level is responsible for the total finances of the entire Directorate. The Director determines the amount of excavation needed in the area and then bids the work to private or public companies. The District Engineer puts in a proposal of what is needed in the district and the Director then incorporates that into the annual budget. Many Directorates only let three contracts for the entire directorate based on the size of the canals.

The Directorate is divided into Inspectorates with the Inspectorate divided into three or four districts of approximately 50,000 feddans each. The Inspectorate is responsible for reviewing the requests made by the District Engineer and recommending those requests to the General Director. The Inspector has a Director of Works responsible for each district. The Inspectorate is primarily a technical subdivision to provide technical review and recommendations to the higher echelons and back to the district. The irrigation district has no other technical people besides the engineer.

District Engineers have minimal authority but tremendous responsibility. They have no control over incentives for their employees and they cannot hire or fire or fill positions. The district has minimal equipment to ensure that the work is completed. Contractors carry out most of the maintenance. The contracts are let by the Director and supervised by the district engineer. There is generally only one car in the district for transportation to work sites and for directing employees. The Engineer has the responsibility for over 100 employees and no effective way to communicate or delegate responsibilities. All maintenance in the district is manual labor and some employees have to provide their own manual tools. Many of the bahari and employees are also water users or farmers within the district.

The engineer receives no additional money for maintenance of the building or improving the canals or providing for more materials that would allow his employees to do more work. With manpower available the only constraint for doing more work is to have the necessary materials. The districts have a car for transportation for the engineer and have several tractors with pumps for flushing the collector drains that must be flushed at least once per year. The tractors are evidently not used for more than this flushing although they could be used with a chain to dislodge weeds and grass to be able to have better control over weeds in the drains.

Central Directorate for Water Distribution

Egypt has a very limited water supply and the need for water forecasting is very important. Any water not required for crop growth is lost into the sea. By international treaty Egypt has only 54.5 bcm from the Nile River System. There is no other large supply of water for the entire country except in localized areas where deep groundwater may be available. Water delivery from the High Aswan Dam can be up to 350 Mm3/day and takes 12 days before it reaches the last area for irrigation in the North Delta. There is storage behind the barrages on the Nile to adjust the flows with storage available of about 250 million cubic meters. Therefore demands in the North Delta must be forecast at least twelve days in advance of the actual demand. There is an allowance to make adjustments in the delivery using the barrage storage but it is very limited. Based on the small size of the farms and the liberalization of cropping, there is no control by the central government of water demands as there were in the past. Therefore releases are made based on a best estimate of requirements. Mismatch of releases from the High Aswan Dam to the actual crop demands leads to wastage of water to the Mediterranean Sea. Another Tranche V benchmark addresses this mismatch.

The central directorate makes the determination of the water demand using a computer model to identify the crop demand. Shortages are distributed equally to the directorates and to the districts. There is no request by individual districts or directorates for a certain allocation of water. Formation of an Integrated Water Management District requires that there be a mechanism or a responsible individual to advise the District Engineer on water needs and then how to distribute the water.

Water released from the HAD is then distributed to the offtakes from the Nile by the Water Distribution Authority. Return flows through drains or other mechanisms to the river system are then included in the total available water supply for irrigation. Therefore efficiency savings in Upper Egypt do not add to the water supply for the country. The central directorate distributes the water among all the directorates. The directorate water engineer then divides the water between the districts. The district then determines the settings of all the branch canals to deliver the water available. If there is a shortage, the shortage is distributed equally among the diversions and directorates and down to the districts. The districts do not have the opportunity to request and receive a certain quantity of water.

Groundwater Sector

The Groundwater Sector is organized under the Irrigation Department of the MWRI at the Central level for the coordination of groundwater use within Egypt. It also has a directive that all issues with water resources should be considered as water resource utilization not just irrigation or drainage of groundwater. The sector has three central administrations dealing with groundwater 1) Western Desert, 2) Eastern Desert and Sinai and 3) Valley and Delta. These administrations are over eight directorates. There is no support on the district level. However, groundwater is a portion of the water supply available to many irrigation districts and should be considered in the organization with a specialist to advise on the use, protection, and management of the groundwater resource. The central directorate has provided the funds for some small wells but this practice has been discontinued. The sector will provide support and guidance about the use of the groundwater resource.

Concern of the groundwater specialist should be focused on volumes and water quality as well as the supply. The issues that are dealt with are recharge rates and the potential for

seawater intrusion. The value of groundwater sources to the district should be evaluated also. Most of the wells have a yield of about 350 m^3/hour. The operation of the wells is at the direction of the district engineer and generally operates 8 hours per day during shortages and only during the branch canal rotation or 1/3 of the time. The most effective utilization of the groundwater wells is probably for municipal use or for the use of an individual mesqa. Because of the limited amount of water, groundwater development is not an effective use of district funds. The development of drainage water is a much more effective use of limited district resources. A more effective policy on groundwater is probably to encourage water users to drill private wells by permit and allow the depths to be no greater than 40 meters.

Central Directorate for Canal Maintenance

The Canal Maintenance Section is a new program that has been formulated to assist in ensuring that channel maintenance is systematically performed across the entire Nile system. Donor agencies and the Government of Egypt fund the program. The Preventative Maintenance/Channel Maintenance program through USAID provided equipment and maintenance facilities for larger equipment to six directorates but this portion of the channel maintenance has not been included in the responsibilities of this directorate. The directorate is primarily responsible for identifying the original design cross-sections of the canals and determining the most effective manner of restoring the canals to those design sections. Efforts for improvements are only in three pilot directorates that do not include any of the directorates included in the Integrated Water Management District. All construction work for this directorate is performed under individual contracts. As the district formation extends into other directorates, this section needs to be recognized for the maintenance that is being performed.

The Menoufia Directorate has equipment from the Preventative Maintenance/Channel Maintenance program. This equipment in the Minuefia Directorate should be prorated to the irrigation district to provide a means for maintaining the canals and drains in the district. This portion needs to be looked at to determine if there is advantage to designate some of this equipment and staff to the pilot districts for the district improvements or maintenance. The district needs some facilities and equipment to better serve the distribution of the water and ensure the canals are maintained in a reasonable manner.

Weed control by the Department is generally by biological methods for those canals that have water in them continuously. The treatment provides control of most weeds with the exception of hyacinths. Hyacinths are controlled with harvesters.

Many of the large canals are too wide and shallow and allow for slower movement of the water and allow the water to warm excessively and thus encourage weed growth. Bahari from the irrigation district are required to be at screens in the canal system several times daily to remove weeds from the screens. The new channel maintenance program is to help rectify the ineffective cross sections by reducing the amount of sediment removal and allows the canals to come back to a more efficient cross section.

Nile Protection Sector

The Nile Protection Sector under the Irrigation Department is responsible for the maintenance of the Nile River system including but not limited to removal of weeds from the river and protection of the river banks from erosion. They also ensure the water quality of the river.

The sector has facilities that they collect samples from the Nile for water quality analysis to enforce the quality of the water by those using the river. The sector needs the districts to be aware that the drainage water discharges to the river need to meet certain water quality criteria.

Irrigation Advisory Service

The Irrigation Advisory Service (IAS) provides assistance in the formation of Water Users Associations (WUA) on the mesqa level under the Irrigation Improvement Program. The WUA organization is to provide a means for the individual farmers to be represented in the operation and maintenance of their private mesqa. The IAS has been working lately on two different types of Boards: a Water Board that is an organization that represents all the stakeholders on a branch canal, and the Branch Canal Water Users Association.

The Water Board includes individuals from the water users, the villages and the industries that depend on this canal. This organization has no real interface with the irrigation district but has been formulated to resolve local issues for the areas served by branch canals.

The Branch Canal Water Users Associations are organizations of water users that has been designed to turn the operation of maintenance of the branch canal to the water users as part of the Irrigation Management Transfer (IMT).

Mechanical and Electrical Department

The Mechanical & Electrical Department (MED) is the organization in the Ministry of Water Resources and Irrigation (MWRI) responsible for designing, constructing, and operating pumps concerned with irrigation and/or drainage in Egypt. The department originally was concerned with all project pumps but the directive has change to be primarily large pumps. Some of the older groundwater pumps are still the responsibility of the department but more recent groundwater pumps are the responsibility of the irrigation directorate.

There is a Director General of M&E and Central Directorates for Upper Egypt, East Delta, Middle Delta and West Delta. They have staff on the local level to maintain and operate the existing pumps.

The M&E Department is fully supportive of a consolidation of responsibilities in an Irrigation District including small pumps. The M&E Department should still be responsible for large pumps and pumps that affect larger areas for the irrigation water supply. The maintenance and operation of small pumping stations should be transferred to the irrigation districts with a letter of agreement and support between the two departments. There appears to be minimal staff at the district level of the Mechanical and Electrical Department.

Water distribution in Egypt is primarily by water levels in the canals after the water is diverted from the Nile. Measurement of flows is on a limited basis primarily by directorates. The districts have no capability for water measurement. Shortages in the district are handled by the district irrigation engineer who sends employees to lock gates on a rotational basis and stay at the gate until that gate can resume diversion.

Drainage Authority (EPADP)

The Drainage Authority has an Authority staff, a Directorate staff and a district staff but no Inspectorate staff. The drainage Authority is the Egyptian Public Authority for Drainage Projects with the primary responsibility for designing and constructing drains in all the Nile River System to ensure the continued productivity of lands irrigated from the Nile River. Most lands under the irrigation system have been provided with drainage and therefore the primary design function is to evaluate the effectiveness of the past drainage and to provide improved drainage when there is the need of replacement. The Directorate or Authority staff carries out design and evaluation of drains. The authority has also assumed the maintenance of surface and collector drains in the last ten years.

The General Director of the Drainage Authority carries a budget and the financial responsibility for all irrigation districts within the directorate. The budget is generally divided into three main categories: salaries, maintenance, and investments. Contractors perform all maintenance and investment works with the contract sometimes being let to one contractor for the entire directorate. The budgetary process is for the entire directorate and does not identify individual districts with a certain budget so that even during the year if there is a need, one district might be shorted to provide for another district. The General Director carries a heavy burden in making decisions regarding the distribution of funds.

The primary district responsibility is maintenance of the existing drains by cleaning weeds floating in the canal and fouling bridges or other structures and to transmit complaints of non-effective drains to the Ministry. There is no direction from the district about reuse of drainage water or about water quality although the district can make recommendations. They also inspect and report on the completion of contracts that the directorate lets to contractors.

The district engineer supervises over 100 employees and receives a check monthly from the directorate for the salaries of those employees. He receives no additional money for maintenance of the building or improving the drains or providing for more materials that would allow his employees to do more work. With manpower available the only constraint for doing more work is to have the necessary materials. The districts have a car for transportation for the engineer and have several tractors with pumps for flushing the collector drains that must be flushed at least once per year. The tractors are evidently not used for more than this flushing although they could be used with a chain to dislodge weeds and grass to be able to have better control over weeds in the drains.

The Drainage Authority has identified that there is approximately 4 billion cubic meters (bcm) per year of drainage water that is wasting into the sea. This 4 bcm per year has been put as a priority for reclamation to allow that water for beneficial use. Present plans are to construct large pumping plants to reuse this water.

Existing District Organizations

Irrigation District Engineer reports to the Inspector who reports to the General Director. There is no other technical staff.

Drainage District Engineer reports to the General Director. There is no other technical staff.

Mechanical & Electrical District Engineer reports to the General Director. The technical staff is limited to mechanics and electricians.

Water Distribution/Measurement

The technical portion of the operation of the district is managed at the directorate level where the water is split to each of the districts. Water is measured at the inflow to the Directorate canals and at the head of each of the district canals. The district engineer divides the water between the branch canals based on a rotation to the branch canals. The rotation is generally five days on and ten days off. Each canal receives a certain level of water when it is operating.

Irrigation Canal Maintenance

This surveying and calculation of quantities for excavation of contractors are generally done by the district engineer but are checked by the inspectorate engineers. The final excavation quantities are determined by the inspectorate engineer for the Director to include in maintenance part of the budget.

Drain Maintenance

The technical support for the drains comes from the directorate and the Authority. The directorate determines the quantities of excavation required and the central authority engineers determine the design of tile drain systems for undrained areas or replacement drains for ineffective drains. The district drainage engineer ensures that the drains are cleaned of weeds but only has hand tools for the employees to use. He does have a washer machine to clean collector drains on an annual basis.

Limitations and Issues for Integrated Water Management

Water resources management is divided on the district, directorate and national divisions. This division of management with the accompanying divergent policy for each of the management organizations leaves the integration of all the water resources difficult to implement. The district engineers many times coordinate activities and work well together but that is dependent on the personalities of the engineers. This lack of integration of water resources policy at the district level limits water conservation, water reuse and groundwater use along with water quality management. Policy implementation will only be to be applied if there is the appropriate structure on the district level to encourage those policies.

Lack of Authority

Lack of authority or control by the district engineer over all of the water resources limits the effectiveness of the engineer and totally eliminates the potential for an integrated water resources policy. This lack of authority and great responsibility includes the lack of control over a budget to purchase materials for the employees to use for maintenance of the canal and communicating with the employees on their completion of duties.

There is a lack of control over finances at the local level. The district engineer receives the salaries and disburses those salaries to the employees but has no other financial control except as the General Director gives him vouchers for some materials. The district engineer

budget is nonexistent and the duties of the irrigation, drainage and mechanical districts all deal with the water resource but only a limited part of it. The three districts could be combined to remove redundancy of activities and coordinate protection and use of the resource. A portion of the budget needs to include the budget for operation and maintenance of the district pumps.

Water Distribution

Water distribution to the district is controlled by the directorate based on flow with distribution of water in the district presently based on water levels and rotation of turns in each branch canal. Therefore shortages are handled by reducing the amount of time on rotation to individual mesqas. The lack of measurement capabilities within the district limits the amount of flexibility that can be given to the individual mesqas or water users. The district cannot begin a systematic effort to provide for water shortages by constructing small water reuse schemes because of no funds for such projects, no method to allocate the reclaimed water and no coordination with the drainage district that is responsible for the drains.

Maintenance

Large maintenance is the responsibility of the directorate to contract with private firms to clean the canals because of the lack of funding for the districts. It appears that there are minimal budgeted funds for small maintenance projects. Part of the lack of funding is due to the inefficiency of the contracting process and partly due to the profit and liability issues that the private firm has to add into the bid. The district has only been responsible for keeping the screens clean and inspecting the work of the contractors performing the work for the directorate. The district cannot perform any more than manual maintenance because there is no cleaning equipment, budget, materials or plan. The district also has very limited transportation resources to communicate and move from one location to another in the district for maintenance or to transport maintenance materials. The district has limited access to materials to ensure that improvements or repairs are accomplished in a timely manner. The contracts let by the General Director are very large and the companies that receive these projects are very large. They perform the work on the canals when it is most convenient for them, not for the water users or the district. Usually the district engineer does not know of the construction plan until a short time prior to mobilization. Therefore the engineer cannot inform the water user with any anticipation of schedule or length of time of the contract.

Conjunctive Use

There is no conjunctive use policy for the district. Drainage is responsible for the drains and the irrigation district is responsible for delivering water from the Nile. Without a plan of action, the districts will not develop any reuse capability. One district has recommended a reuse project that has never been approved by the General Director – probably because the directorate does not have the funds for a project such as the one proposed. There is no policy within the district for groundwater use. Apparently groundwater use is easier to implement because each district does have several groundwater wells that they use to supplement irrigation water supplies.

Communication with Water Users

Communication between the farmers and the district need to be strengthened. Communication between the district and the bahari is also limited. The communication is limited primarily because of the lack of transportation. The bahari are the first line of communication between the farmer and the district and as such they could be one of the most effective public relations messengers for the district but with lack of information to the bahari, they cannot communicate anything to the water users. They could communicate information to the water users daily if the district communicates with them and informs them of details of the canal management.

Solid Waste

Solid waste being thrown into the canal is a major water quality problem near communities because the canal appears to be the only location to throw solid waste. No one can identify who is depositing the solid waste because everyone is doing it. There is no designated location to put or dispose of the trash. Most of the scraps that can be composted and recycled are already recycled but other packing type materials and coarse farm materials do not have a location for disposal. This sold waste attracts rats, creates noxious odors, creates health risks, blocks the canals and floats to the gates where it creates problems with the distribution of the water.

Sewage

Sewage and industrial liquid wastes are another major water quality and health problem. Discharging sewage to the canals leads to irreversible degradation of the water in the canal or drain, it leads directly to contamination of the shallow groundwater that has been used for some community's water supply. The waste then is discharged to the fields where the farmer has to wade in it and has the potential for sickness and death from the contamination. Sewage in the canals near the communities presents a tremendous health issue since many canals are used to wash dishes and clothes and bathe. The raw sewage transmits coliform to the canal as well as assists in the schistosomiasis cycle and the introduction of additional BOD into the canal that depletes the oxygen in the water, kills fish and creates terrible odors.

Proposed Irrigation Directorate Organization

The Directorate will have a different role - that of ensuring maintenance on the main canals, overseeing maintenance and operation in the district and requesting water for the individual districts. The directorate will have authority to inspect the operations of the district and make recommendations to the Central Ministry. The functions of the Inspectorate have been primarily to provide technical support and approval to the District. Therefore, the inspectorate may be phased out or may be included in the directorate functions and the technical support will enter the district level to provide review and technical input to the District Official and the District Council. This organizational issue is best resolved by each General Director. The General Director will have his director of works or staff with an engineer to advise him in all aspects of the district operation. There should probably be one director of works to oversee each district. The directorate will still provide technical oversight of the district operations and will review the financial status of the district.

The General Director of Irrigation is responsible for the continued operation of all the irrigation facilities in the Directorate. His budgeting process will continue even with the organization of integrated water management districts throughout his directorate. He still needs to maintain the large canals and provide the construction of large structures. The district funds should be from the directorate funds based on the number of feddans in the district. The revised process should redistribute the funds based on the funds needed for salaries of the number of employees that the district has. A suggested distribution could have the district maintenance as 40% to 50% of the directorate budget based on feddans and the district investment budget to be 25% of the directorate budget based on feddans. The budget of the revised Directorate would be reduced by the amount that would be removed for all of the districts in the Directorate. If an inspectorate organization continues, the funding should come out of the Directorate portion of the budget. The following table shows the budget for the two directorates with the chosen pilot districts and the proposed allocation to the districts.

Minufeya Irrigation Directorate

		Total Employees	**1,501**
		Total Area (feddans)	**404,000**
	Directorate Budget	Directorate Budget	Potential District Portion
Salaries	3,500,000 L.E.	(per feddan)	(per feddan)
Maintenance	2,500,000 L.E.	6.19 L.E.	3 L.E.
Investment & Construction	4,500,000 L.E.	11.14 L.E.	3 L.E.
Preventative Maintenance	800,000 L.E.	1.98 L.E.	1 L.E.
Telemetry	100,000 L.E.	0.25 L.E.	
Total Budget	**11,400,000 L.E.**		
Budget/feddan (total)	28.22 L.E.		
Budget/feddan (wo salaries)		19.56 L.E.	7 L.E.

West Sharkia Irrigation Directorate

		Total Employees	**857**
		Total Area (feddans)	**268,000**
	Directorate Budget	Directorate Budget	Potential District Portion
Salaries	1,714,000 L.E.	(per feddan)	(per feddan)
Maintenance	3,500,000 L.E.	13.06 L.E.	5 L.E.
Investment & Construction	5,050,000 L.E.	18.84 L.E.	5 L.E.
Total Budget	**10,264,000 L.E.**		
Budget/feddan (total)	38.30 L.E.		
Budget/feddan (wo salaries)		31.90 L.E.	10 L.E.

With this proposed budgeting, the directorate will still have the needed funds for major work and the district will have funds to determine and allocate in the most effective manner possible within the district.

Proposed Drainage Directorate Organization

The Drainage Authority has the title of Egyptian Public Authority for Drainage Projects (EPADP). Its primary objective and its purpose is to design, construct, and rehabilitate drainage works. The proposed reorganization transfers the responsibility of operation and maintenance to the Integrated Water Management District. EPADP remains a technical organization for support, construction and design and is responsible for drainage projects. The technical support will be to review the function of the drains and review if there are drainage complaints that cannot be taken care of by the district. It would then design and replace the drains that are beyond cleaning and maintenance potential

The General Director of Drainage is presently responsible for the continued operation of all the drainage facilities in the Directorate. His budgeting process will continue even with the organization of an integrated water management district and delegation of all drain maintenance functions to the district. The directorate will then have no maintenance responsibilities. The revised process should redistribute the funds based on the funds needed for salaries of the number of employees and the number of feddans in the district. A suggested distribution would provide the district maintenance budget as 90% of the directorate budget based on feddans and the district investment budget to be 8% to 15% of the directorate budget based on feddans.

The following is a proposed division of the budgetary requirements of the two pilot Drainage Directorates with the Integrated Water Management pilot districts:

Minufeya Drainage Directorate

		Total Employees	**670**
		Total Area (feddans)	**193,393**
	Directorate Budget	Directorate Budget	Potential District Portion
Salaries	718,000 L.E.	(per feddan)	(per feddan)
Maintenance	1,745,000 L.E.	9.02 L.E.	9 L.E.
Investment & Construction	4,965,000 L.E.	25.67 L.E.	2 L.E.
Total Budget	**7,428,000 L.E.**		
Budget/feddan (total)	38.41 L.E		
Budget/feddan (wo salaries)		34.70 L.E.	11 L.E.

West Sharkia Drainage Directorate

Total Employees **670**
Total Area (feddans) **268,000**

	Directorate Budget	Directorate Budget	Potential District Portion
Salaries	847,000 L.E.	(per feddan)	(per feddan)
Maintenance	3,000,000 L.E.	11.19 L.E.	11 L.E.
Investment & Construction	5,000,000 L.E.	18.66 L.E.	3 L.E.
Total Budget	**8,847,000 L.E.**		
Budget/feddan (total)	33.01 L.E		
Budget/feddan (wo salaries)		29.85 L.E.	14 L.E.

Proposed Integrated Water Management District

The organization of an integrated water management district needs to consider all the irrigation community requirements. This plan (See Figure E-1) deals with the whole of Egypt even though the specific study focused on two pilot districts. A final organization should be flexible to the needs of the irrigation district and be specific to that district and the personnel of that irrigation district. The following sections and departments within the district are those that should be represented. The district supervisors and staff should develop a listing of the district goals and coordinate those with the Markaz Board. The organization for each district should be developed by the General Director in coordination with the engineers that will be forming the Integrated Water Management District.

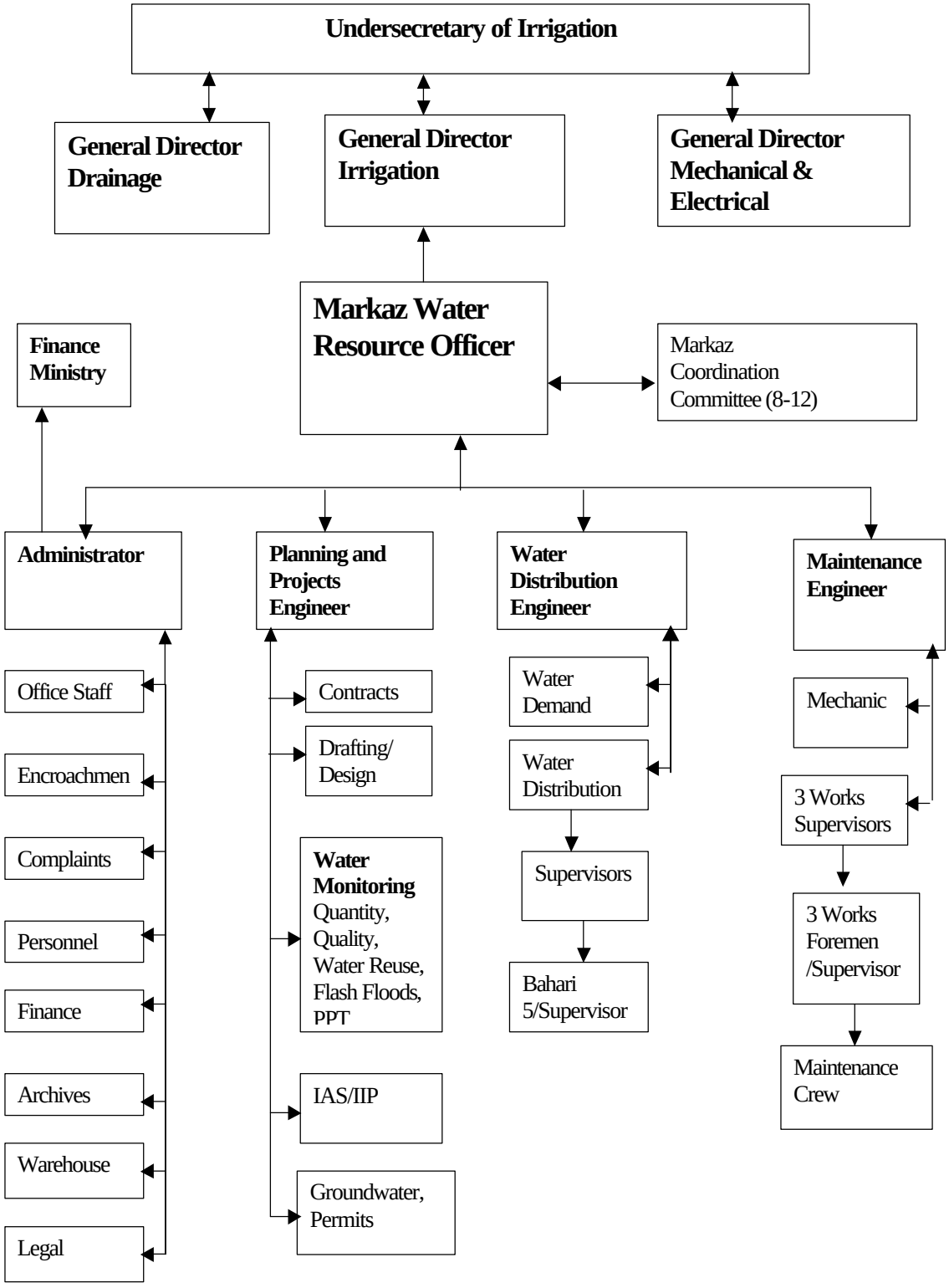
The engineer heading the district has more authority and responsibility than the existing district engineer and thus the engineer should be on a working level with an Inspector and his title should reflect the increased responsibility. A title could be: "District Water Resources Official" indicating the responsibility over all of the resources of the district as well as his increased responsibility. He/she should have less than seven supervisors reporting directly to him/her and then be able to delegate work to those supervisors. If more than seven have to report directly to the manager, the effectiveness of the manager is reduced. The need exists to be able to reward employees for extra effort and pride in their job.

The Official needs to delegate authority to the supervisors so that each is responsible for a set group of employees with well-defined duties. The Official is ultimately responsible but at the same time the work is undertaken more effectively if he has a staff that he can trust and depend on to accomplish the goals of the district. Incentives and bonuses should be used to justly reward employees for effectively accomplishing their duties and goals. The District Official and his supervisors should be given incentives based on the determination of the General Director. The other employees should receive incentives based on the recommendations and the evaluations of their individual supervisors in consultation with the District Official. All of the engineers should be trained in the duties of the other engineers to allow for sickness and vacations when the engineer can be temporarily away from the duty station.

The Integrated Water Management District is an entity that has sufficient manpower and material and fiscal resources to maintain the canals under its jurisdiction. The primary responsibility of the district is to deliver water to the users. Therefore, all of the divisions are a support to the water distribution section to ensure that water is delivered equitably. The primary limitation that any district presently has in maintenance is the necessary tools and materials. Employees should be paid for their value to the district and therefore must have the tools and the materials to keep them busy. Most districts should have an excavator or backhoe to clean canals and use as a tool in the maintenance and improvement of the district. They should have two washer machines with tractors and one or two construction wagons to carry materials. They should also have adequate transportation (cars and motor cycles) to be able to oversee the maintenance being performed. Equipment should be scheduled so that it is effectively used the majority of the time. A record of operations should be kept to evaluate the scheduling on a regular basis.

The supervisors and supervisor engineers need to be delegated the authority to allow them to most effectively support the entire operation of the district. They need to have control over a

Figure E-1. Proposed organizational chart for an Integrated Water Management District.



designated budget and be able to counsel with the District Officer over the most effective methods of utilizing the district resources both fiscal and physical. They are responsible for training those under their supervision. It is understood that none of the employees are trained for the change in duties associated with this reorganization but that it will be the responsibility of the individual supervisors to receive training and then train their employees. Because of the consolidation of duties of three concurrent districts, some positions may not be needed and as much as possible this must be dealt with to provide the most effective functional organization. The organization proposed is a recommendation but should be modified to meet the needs of the individual districts and with the understanding that this reorganization is only part of the total Ministry reorganization. Not all districts will require the same duties i.e. not all districts abut the Nile, not all districts will have equipment, not all districts will have groundwater issues, or not all districts will have drainage water reuse potential.

Water Management Section

The water management section is responsible for determining water needs, requesting those needs from the Directorate through the District Official and then distributing the water equitably among the various branch canals. The section should have two main divisions. The first is a division to forecast water demand for the next 15 days using tools developed for the MISD portion of the EPIQ project. The MISD tools help allocate water to the branch canals after the water has been allocated to the district. This section should include the additional water supplies available to the district such as reuse water or groundwater. These additional supplies should reduce the amount needed from Nile River sources. This section coordinates with the directorate staff to determine the most effective way to distribute water. Each district should have one set of measurement instruments with transportation to assist in distributing and measuring water.

The second division is concerned with the delivery of water. The bahari are under the supervision of this water master. Every five bahari are under a bahari supervisor so that the supervisor is responsible for keeping the bahari informed, in training them to do their job more effectively and to assist them in communicating better with the water users. The bahari open and close gates so the water is equitably distributed according to the direction of the water distribution staff. The bahari should be directed to keep the branch canals as clean as possible and they should clean it as necessary, not waiting for the maintenance people to come before it gets cleaned. During shut down periods they should be prepared to participate in cleaning their canal or coordinate with other bahari or with the maintenance crews to assist them in cleaning other canals and drains. Bahari and supervisors should be consulted on the needs of their branch canals so that the canals are more able to distribute the water equitably.

The bahari are responsible for the distribution of water along branch canals to individual mesqas. Their duties at the present time require water distribution during five of every 10 or 15 days depending on the canal rotation. The remainder of the time should be spent in improving the branch canal and ensuring continued water deliver. Since canals are dry a significant portion of the time, maintenance should be scheduled to meet these times. Each bahari should know approximately the design cross-section of his branch canal and should work to get the cross section to the design or most efficient cross section. There could be a competition among bahari to have the best branch canal in the district. The competition would provide an incentive for the bahari to take more pride in their canal. There could be three branch canals selected each month for the prize. One half to 2/3 of the canals in the

district will always be dry and these dry canals should be scheduled for maintenance. Each bahari supervisor could use his idled bahari for maintenance during the dry period. Sections of the canal could be scheduled so that the maintenance was rotated.

Complaints should go first to the branch canal bahari. He should correct the complaint if possible and report to his supervisor. If he or his supervisor cannot correct the complaint then it should go up the next level. Complaints should be taken care of as low on the organization chart as possible. More difficult complaints should come to the District Official and the Markaz Board. Complaints should not bypass the bahari or his supervisor but should it need to go higher, it should come through the board member that is responsible for that area. Therefore the District Official will receive complaints through the supervisors or the Markaz Board but not from individual water users. Complaints from parliament members are an abuse of the system and should not be allowed.

Maintenance Section

This section is a support section to water distribution and should schedule so that water distribution is most effective for the water users. The maintenance foremen should be aware of the design cross-sections and work to bring the canals to that section. They are primarily responsible for maintenance. Contracts to private companies should be small and should be let only as a support to this section's efforts.

This section is responsible for maintenance of canals, canal roads and drains within the irrigation district. The official is responsible for training staff or obtaining staff that is skilled in the performance of the needed duties. The maintenance crews should be divided into crews of 5 to 10 men with a foreman for maintenance and improvements to the canals and drainage works. They should be divided in the types of work as well as into district work areas. Types of work might include concrete, pipe, general weed cutting, pitching, and cleaning as examples. However, each crew should do what they can without trying to get specialists. There can be specialist teams to clean or to repair or to place concrete and specialist teams to maintain subsurface drains. The head of this section should have assistants to supervise the works. The supervisor of this section should have no more than six foremen reporting to him. The section has direct responsibility for maintaining the drains and canals free from garbage and trash including weeds that will plug the facilities.

One crew is responsible for the maintenance of collector drains and should clean the drains on a regular schedule. When the tractors for washing are not being used they should be using the tractors for other maintenance activities. The collector drain washing is the highest priority for the washer. The section should also have access to one excavator, one side-slope ditcher, and two construction wagons for use with the tractors. They should have adequate heavy chains for pulling the ditcher through the canals.

The section is responsible for the maintenance and operation of all district pumps and equipment. They operate the district pumping stations as scheduled and determined by the water section. They ensure that there is adequate fuel at each pump site. They maintain a history of each piece of equipment or pump in use. Preventative maintenance should be emphasized in all of the canals and the equipment. Each pump should be inspected and checked to replace packing and overhaul the motors as needed each year. Impellers should be replaced or hard surfaced as they wear.

The section maintains and operates the transportation for district staff and ensures that the maintenance equipment is always in operating conditions. The drivers and operators would be in this section. Scheduling in this section would attempt to utilize the equipment to the utmost and have it constantly being used in the maintenance of the canal. The maintenance section, the technical section and the water distribution section would make requests for needed equipment at which time this section would schedule the available equipment.

The section would be responsible for maintenance of the buildings in the district including the primary office and additional yards for storing equipment and materials closer to the work sites.

Planning and Projects Section

This section is responsible for detailed plans necessary for improvements to the district and for the rehabilitation of the drains and the canals within the district. This section proposes improvements and changes to the operating plans of the district to be taken before the District council to be authorized and budgeted. The proposals would include budgets that would need to be approved. The section provides plans for contractors to work within the irrigation system and inspect the works as they are in progress. This is a support organization to support the water distribution section and the works section in being able to more effectively carry out the distribution of the water.

One of the technicians should specialize in environmental issues, conjunctive use, and permitting within the district. The section is responsible for communications between Water Boards and the district.

Administrative Section

This section is responsible for all of the administrative duties of the district including payment of salaries, finance, archiving, complaints, encroachments, legal, secretarial, phone operators, tea boys, etc. The section should also assist in preparing the annual budget by receiving requested budgets from each of the section supervisors. The administrative section supervisor should determine the actual personnel needs and responsibilities within the district and should reorganize the staff accordingly. Several responsibilities could be combined such as secretarial, telephone operators and archiving. All this can probably be handled by the same 2 or 3 persons. Apparently there is an operator around the clock but this is unnecessary since the farmers don't irrigate much at night and the calls for the district at night are also limited. Since this section is consolidated from three different districts with the same duties there might be the necessity for a reduction in the number of employees in this section.

The financial portion of the section prepares the budget for the District Official. They receive input or a budget prepared by each section supervisor and combine that for a total district budget. The official then takes this preliminary budget to a council of the section supervisors to discuss and adjust the budget according to the actual funding of the district and the priorities that the Officer and council sets.

The administrative section includes:

Telephone Operators (Communications)			Guards	Archiving
Financial	Complaints	Tea boys	Legal	
Encroachments	Warehouse	Personnel		

Irrigator Coordination Committee

The formulation of an irrigation district requires an organization of the water users to advise the district on the interests and needs of the water users in the district. However, an organization of the users on the mesqa or even the branch canals requires so many individuals than it would be unable to accomplish anything. A user organization needs to be formed that has at the most 12 members to work with the District Officer. The District Officer could be considered as one member of this committee representing the Minister. The committee would have two main objectives with the first to advise the District Officer, the second may be more important: to provide a public forum so that the water users can voice their needs and ideas for improvement of the canals.

This board should be composed of 8 to 11 irrigators that are elected to represent the needs of the water users. Each water user should have two votes, one for himself and one for his wife. The water user or his wife could be elected to the committee. They should be organized to have a chairman or president and two vice presidents. The District Officer should act as the secretary. Decisions require the vote of a majority of the committee. The committee must have a quorum prior to undertaking any business. The committee reviews the budget and maintenance plans prior to sending the budget to the Directorate. They assist in prioritizing the maintenance needs.

Organization of this coordination Committee initially could be by selection of the District Officer in consultation with the District Council and the bahari whose region the director is to come from. We suggest that the individual directors be selected randomly to have a one, two, or three-year term with 1/3 selected for each tenure. At the completion of a term a director would be elected to fill the expired term for a three-year term. The committee should meet on a definite evening once per month in one of the districts rotated monthly so that all water users can participate in the public meetings. This Coordination Committee should receive a minimal per diem allowance for attending meetings to offset transportation costs and loss of time from home. A suggested per diem is L.E. 50 per meeting. The following is an agenda of suggested discussion items for the regular meetings:

- Call to order
- Old Business
- Budgeting Issues
- Maintenance actions for the coming month
- Prioritization of maintenance and Improvements
- Investments
- New Business
- Adjourn

Proposed Solutions to Limitations

Lack of Authority

The district officer should be given the authority to manage the budget as well as control the personnel of the district. The primary item that will give the Official authority is to give him/her a budget to manage and make decisions. The following is a listing of the items that should be in such a budget. These may not be all the items included or there may be some that do not need to be included. The items for health insurance and social insurance are a reminder that the overall plan needs to keep these items in consideration even though the government is now responsible for these items. The budget items are:

- Salaries
- Health Insurance
- Social Insurance (retirement)
- Equipment (large and small)
- Capitol Investment (new equipment and replacement of old equipment)
- Maintenance
- Fuel
- Repairs, Spare Parts
- Canal Maintenance Materials: concrete, rock, sand, fill, gates
- Building Maintenance, Plans for Repairs, and Repairs
- Office Utilities
- Office Supplies

It appears that the Ministry budgets about L.E. 70 per feddan for irrigation and drainage directorates combined. We recommend that approximately L.E. 34 per feddan be designated for the IWMD and this be taken from the budgeted amount for the respective directorates. Money that is saved in salaries by attrition of reduction in force should remain with the district for maintenance and additional equipment. Some items ion the wanted list as far as equipment and buildings might have to be budgeted up to five years in advance. A formal plan should be prepared by the district for capitol purchases for a minimum of five years.

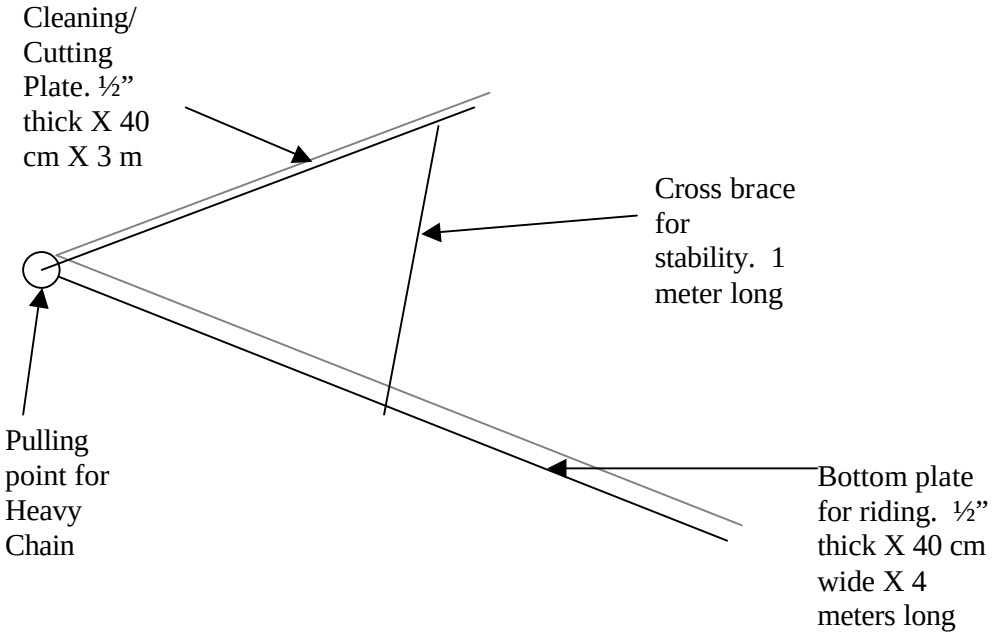
Water Distribution

Water resource needs to be considered from the point of the overall water budget of the IWMD and of Egypt. The irrigation districts need to be able to measure flows going to each of the branch canals so that water can be equitably distributed to the water users. This measurement of flows can begin with rating curves for each of the branch canals. The directorate could help to rate the gates. Without measurement, the only distribution is on the basis of the water levels in the canal and by reducing the rotation. This does not take into account the potential for drain water reuse and groundwater use. Therefore shortages cannot be equitably distributed unless there is measurement of the flows. With the potential for measurement, there also comes the possibility of longer rotations and smaller canal sections to distribute the same amount of water. The drainage reuse and groundwater use available should be included in the overall water budget of the district.

Maintenance

Maintenance of many of the smaller structures has been largely lacking because of the ability of the districts to make do with what is available. Cleaning of branch canals is limited because the main canals need the attention so much more. The branch canals are so small that the large excavation companies cannot afford to do the work except at an excessively large price. Therefore, it is in the best interest of the nation to provide the Integrated Water Management District facilities and equipment sufficient to maintain the branch canals and repair and replace the small structures by themselves or in conjunction with a small independent contractor. Each district should have one backhoe that is obtained as an investment expenditure. The backhoe purchased should have a good history in Egypt so that the repair parts are readily available. There may no be an operator at present in the district but one should be able to be trained or recruited. The district should also obtain a ditcher that can smooth and clean one side of the canal at a time and be pulled by a tractor. Each district should have at least two washing machines for washing and flushing collector drains. In this setup the tractor can also be used to clean the canals with either a large logging chain between two tractors that flattens the weeds or a side-slope ditcher that can be used to remove growth from the sides of the canal or drain. The district should also plan to have one construction wagon for material movement for canal and drain maintenance.

The following is a rough plan (See Attachment E for pictures of the ditcher) of a side-slope ditcher for cleaning the banks of the canal. It should be of steel construction that will allow a man to ride the ditcher and push the cutting blade into the edges of the canal:



The bottom riding blade runs along the bottom of the canal with the cutting blade sharpened and used to cut vegetation and roots hanging into the canal along the side. It also pastes the vegetation to the side with the resulting mud being cleaned from the edge of the canal. Both the cutting blade and the bottom plate are strengthened with a T beam running along the center of the plate to provide strength and stability. Joints between the cross brace and the ditcher blades should be flexible (not welded).

Conjunctive Use

Water Reuse

Egypt National Water Plan proposes that drainage reuse should be increased by 4 billion cubic meters per year. The water saved from this reuse would be available for the development of new lands. For the reuse to be most valuable to the Nile River system it must be in the south delta prior to excessive salinization of the drainage water. At present the majority of the drainage water in the delta south of Mansoura is good for irrigation with minimal mixing. This indicates that effective reuse could be accomplished in each irrigation district by pumping the drain water back into the ends of the branch canals. If the 4 billion cubic meters of reuse water is spread over 4 million feddans, each irrigation district would be responsible to capture 10 million cubic meters of drainage water per year from the drains for every 10,000 feddans included in the district. This reuse should be continuous so that as much water as possible is reused. This reuse should be a goal for each district in the delta. This reuse should be included in the district's water budget and should be developed in accordance with policies of the Ministry. Small recapture stations could be built on the drains where two branch canals meet. Pump stations that could pump 350 m^3/hr would be able to supply each of the two branch canals and reduce the demand on the Nile System by 2 million cubic meters per year for each pump station. If the pump stations were designed so that the pumps and the structures were similar (package plants), there would not be the need for individual designs and the resulting delay for each pump station. The pump station should also be designed with a spare pump installed to allow for operational rotation and flexibility in the face of water shortages. The long term plan could be to install one pump station per year or as the funding is available from the budget to initiate this reuse plan. Locations of pollution would be less critical since the water would be going into the ends of branch canals and not into main canals that are eventually used for domestic water supply. Locations in the drains should be considered for small dams (less than one meter of storage) for regulating the availability of water for these drain pumps. This quantity of storage would allow additional capacity in the case of an unforeseen shortage.

Groundwater Use

Groundwater use could be envisioned in this same scenario and in some districts it has been supplied but is only used in time of shortages. However, there should be clear understanding about the purpose of the resource and the potential for other uses. At present Ministry estimates set the groundwater use at around 3 billion cubic meters per year with a firm yield of 7.5 billion cubic meters per year available. This resource should be clearly discussed and planned as the groundwater is clean and is a much better source of supply for municipalities than surface water. A policy needs to be determined of how to develop the additional 4.5 billion cubic meters. Because of the ability for the water users to supplement their fields, it appears that the groundwater should be a private development venture and also protected for municipal and industrial supply. Development of groundwater for irrigation should not be a Ministry responsibility.

The IWMD should begin a program of receiving permit applications for all groundwater wells within the district and develop a database for use by the district to determine the availability of groundwater for shortages. It seems that the district should work to permit all existing wells and document potential problems of well construction.

The drainage water that is part of a larger scheme such as the El Salaam Canal should be considered in the overall national plan. However, water not available to the El Salaam Canal via drainage just allows the canal to accept more water from the Nile.

Flash Floods

Flash floods are devastating to the areas that they affect. They cannot be controlled because of the vagaries of weather. They can however, be planned for and growers on flood fans should be made aware of the possibility of damage. The water volumes are generally small as compared to the total flow of the Nile that is being delivered for irrigation. Therefore all the water is captured and added to the water supply. Those irrigation districts that are affected by these types of floods should provide means by which the flood will not damage the canal. This could be as piping under or over the canal or the construction of a hardened spillway to allow the water to enter the canal but then allow the spillway to spill the excess water without damage to the canal. A flood event will cause the canal to require cleaning after the event but will not require major repair. In addition, review of the headwaters of the wadi might indicate areas where small flood control structures constructed of rocks or soil cement or roller compacted concrete might be placed reduce erosion, retard flood flows, attenuate flood peaks, and store the water for short periods. These small dams would also collect silt and eventually fill to create places for vegetation to begin growing and further stabilize the wadi.

Precipitation

Precipitation sufficient to supply some of the crop water requirement is limited to areas within about 30 kilometers of the Mediterranean Sea. This source should be considered in the total water balance of the irrigation district. The district's water budget should be reduced by the amount of effective precipitation for the district.

Communication with Water Users

Communications will be improved by having a monthly Coordination Committee meeting close to the residences of the water users to inform the water users on the activities within the district and to receive input about the prioritization of activities. However, communication between the water users and the district should begin at the lowest level possible. This means that the water users or Water Users Associations should communicate with the bahari whenever possible and that the bahari should always be informed as to the activities associated with their Branch Canal. Additional transportation for the supervisors will allow the water users and the bahari to be more informed. The bahari are the first line of communication between the farmer and the district and as such they can be one of the most effective public relations messengers for the district. They can communicate information to the water users daily if the district communicates with them and informs them of details of the canal management.

Solid Waste

Solid Waste is a huge problem for water quality within the Egypt Canal systems. Most villages use the canal and drains that go through the community as the primary refuse receptacle. This creates pollution of the watercourse and contamination of the water used for washing and bathing. These wastes can be one of the major problems for the integrated

district in keeping the canal clean. As the wastes are collected at the end of each canal, they must be deposited somewhere to remove them from the canal.

A potential solution is that the district be a catalyst to help the solid waste problem be resolved. The district in coordination with the villages along a branch canal should designate a fenced refuse collection location preferably along each canal near the village where the refuse could be burned and/or loaded to be disposed of to the desert in a landfill. They should then encourage residents to use this receptacle or location.

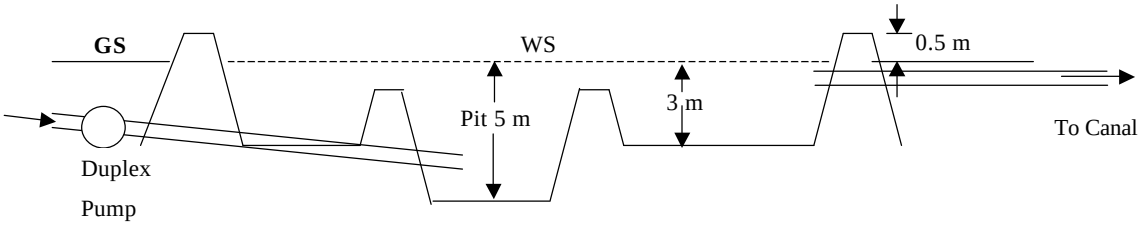
Water Quality

Many of the small villages have no method of sewage treatment so there are many sewers running directly into the canal or drain nearest town. This creates a health hazard as well as endangers the health of the farmers using the water and the potential to create food contamination if the sewage water is used for growing vegetables. The irrigation district has a large stake in maintaining good water quality and also has the authority to require wastewater treatment. The district should be a catalyst in encouraging the villages and cities to treat the sewage prior to discharge to drains or canals.

A sewage treatment lagoon that creates an anaerobic area for the decomposition of the solids and then provides aerobic treatment with the encouragement of algae could provide a major improvement in water quality without excessive costs and it would protect the environment. It would not be complete treatment but would be primary treatment at least. The anaerobic pit will naturally seal because of the deposition of some of the metals in the water. The American Society of Civil Engineers has prepared a design manual for an Advanced Integrated Water Pond System (AIWPS) that would be a preliminary step in the treatment of the wastewater with a minimal impact. The following is a design that would provide the primary treatment. The earthen lagoon could be constructed with earth-working equipment that is now available on contract within most of the irrigation districts. The following is a schematic of the proposed lagoon for a community population of 2,000. A small duplex pump station would need to be constructed to lift the sewage into the lagoon and the lagoon would need to be fenced to protect the health of the residents.

Typical Treatment Lagoon

WS Area of Outside lagoon = 3,300 square meters/2000 population
WS Area of pit = 530 square meters/2000 population
(Not-to-Scale)



Interim Integrated Districts

An Integrated Water Management District organization can be implemented on an interim basis without the inclusion of the drainage district or mechanical/electrical district if the Ministry has not yet completed the necessary policy changes. The General Directors of the irrigation and drainage can each strengthen the individual districts by allowing the district engineer to assume more authority. The Director could authorize an engineer to assume the responsibilities of integrating what the directorate has responsibility for and allowing the engineer to manage a budget. He can also determine some way to allow the engineer to have control of funding for maintenance and investments. He would be able to purchase materials and tools necessary to begin a concerted effort to improve the canal and drainage system maintenance.

Initially there will not be sufficient engineers or trained technical staff for the IWMD. One of the engineers may have to fill more positions than one until the necessary technical staff can be recruited. However, there are three technical engineers in each integrated district at the present and with training of others, responsibilities can be taken care of. The District Official and his supervisors will have the continuing responsibility of training the employees in methods of maintaining and managing water within the district. This will be an ongoing responsibility since there will be a turnover of employees (retirement, transfers, separations) and the vision of the district should be continually expanding. Those employees in the existing district with the desire and the aptitude for expanded job responsibility should be selected for more responsibility and training.

The Inspectorate has been left out of the organization but the responsibility of the Inspector is important and should not be ignored. The organization of the Inspectorate should probably be eliminated in the final plan with the inspector and his function being part of the General Director's staff to coordinate activities and plans for the district with the General Director. The interim plan will not allow this organization removal unless all of the districts in a directorate are started at once.

Initially there will not be measurement of water for the branch canals. Water distribution could continue for some time without measurement but at the same time the Directorate could assist by providing rating curves for each of the branch canal gates. Measurement will become more important as shortages increase and there is more conjunctive use.

The following are the steps that are necessary for implementing an Integrated Water Management District.

1. District Engineers empowered with more authority and funding.
2. District Engineers take responsibility for training their staff.
3. Combine the three districts into an IWMD.
4. Implement measurement and management of all the water resources.
5. Implement a more continuous monitoring program for management.

Pilot Integrated Water Management Districts

Two existing irrigation districts were selected to identify the form of organization that could be used in an integrated water management district. These districts were selected on the basis of cooperation between the existing districts, the Inspectorates and the Directorates as well as the willingness and interest of the engineers affected to investigate a new organization.

Washing machine tractors have idle time in which the services of the tractors would be well used in other maintenance of the drains and canals. If two heavy log chains were purchased, the tractors could be used to dislodge weeds and debris from the canal and drain systems and for removal at the next screen. With a screen or rake pulled by the tractor the canal could be cleaned quickly at the screens and at the ends.

South Zifta Markaz

South Zifta Markaz is responsible for delivering water to 39,000 feddans in the Governorates of Minufeya and Gharbia in the middle delta. The eastern boundary is the River Nile with the western boundary the Bahr Shibin and Homhug Drain. The north ends at the Dahlura Drain. The proposed markaz boundaries were arrived at by the work of the Irrigation District and the Drainage District so that the boundaries of the two districts are concurrent. The proposed markaz would have total responsibility for water delivery and drainage of the area delineated by the boundaries. This includes water delivery, budget, groundwater, drainage water reuse, Nile water, maintenance of the facilities, as well as coordination with other entities within the boundaries of the markaz. A more effective district would be to include all of the three canals, not just the north 2/3, that supply the district so that the district is responsible for all of the canals that it delivers water from and all the drainage water that arises in the district. This would also give the district more control over any point source pollution problems in the drains.

Budget for the markaz would be from the irrigation and the drainage directorates and is equal to the budget that is presently being expended for the markaz. From the Directorate budgets it appears that the following is the budget that should be allowed for the markaz.

Irrigation			
Salaries	110 employees		L.E. 227,000
Maintenance		3 L.E./feddan	L.E. 117,000
Investment & Construction		3 L.E./feddan	L.E. 117,000
Preventative Maintenance		1 L.E./feddan	L.E. 39,000
Drainage			
Salaries	100 employees		L.E. 200,000
Maintenance		9 L.E./feddan	L.E. 351,000
Investment & Construction		2 L.E./feddan	L.E. 78,000
TOTAL			**L.E. 1,129,000**

The Nile pumping station and the groundwater pumps operational expenses has not been considered in this budget but should be. The operation and maintenance responsibility of the small groundwater pumps is for the district. The mixing pump on the main drain should

remain the responsibility of the Mechanical and Electrical Department. The district should plan to start developing reuse pumping plants that will operate similar to the plant that was just installed on the Nile for supplementary irrigation water. The Nile station should seriously consider an electrical supply if it is at all possible. Some serious industrial contamination of one drain was evident.

The following is a proposed budget for the district:

Proposed Budget

Salaries L.E. 427,000	
Health Insurance	
Social Insurance (retirement)	
Equipment (large and small)	
Capitol Investment (new equipment)	L.E. 200,000
Maintenance	L.E. 100,000
Fuel	L.E. 75,000
Repairs, spare parts	L.E. 50,000
Canal/Drain Maintenance Materials - fill, gates	L.E. 100,000
Maintenance Contracts	L.E. 50,000
Construction Contracts	L.E. 42,000
Building Maintenance & Repairs	L.E. 50,000
Office Utilities	L.E. 20,000
Office Supplies	L.E. 5,000
TOTAL	**L.E. 1,129,000**

This budget is considerably less than the proposed 34 L.E.per feddan. The amount available was drawn from the Directorate budgets and might be some error for this preliminary investigation. However, the district should be budgeted the full 34 L.E. with the remaining coming from the Ministry so that the Directorate is not shorted for the remaining districts.

Ibrahimia Markaz

The Ibrahimia markaz is comprised of the 90,000 feddans with the drainage district becoming one where it was two drainage districts. The new district is a little smaller than the original district because of this joining of boundaries and coordination between the irrigation district and the drainage districts. The district is bounded on the south by the City of Zagazig, and Bahr Muweis, on the east by the Bahr Muweis and on the west by Bahr el Sinelti and Bahr Safi Canal. District offices are in Ibrahimia with one irrigation office and two drainage offices. The district has two cars and four tractors with washing machines. The limitation for the district at the present is the absence of materials for the employees to use for maintenance of the drains and canals.

It would also appear that a priority should be budgeting for the purchase of a backhoe for cleaning of the system and for use to improve the overall operation of the water delivery and drainage.

Funding for the markaz would be from the irrigation and drainage directorates and is equal to the budget that is presently being expended for the markaz. From the Directorate budgets it appears that the following is the budget that should be allowed for the markaz.

Irrigation			
Salaries	123 employees		L.E. 246,000
Maintenance		5 L.E./feddan	L.E. 300,000
Investment & Construction		7 L.E./feddan	L.E. 420,000
Drainage			
Salaries	100 employees		L.E. 230,000
Maintenance		11 L.E./feddan	L.E. 660,000
Investment & Construction		3 L.E./feddan	L.E. 180,000
TOTAL			**L.E. 2,036,000**

The following is a proposed budget for the district:

Proposed Budget

Salaries	L.E. 476,000	
Health Insurance		
Social Insurance (retirement)		
Equipment (large and small)		
Capitol Investment (new and replacement equipment)		L.E. 300,000
Maintenance		L.E. 200,000
Fuel	L.E. 110,000	
Repairs, spare parts		L.E. 100,000
Canal/Drain Maintenance Materials - fill, gates		L.E. 400,000
Maintenance Contracts		L.E. 200,000
Construction Contracts		L.E. 140,000
Building Maintenance & Repairs		L.E. 105,000
Office Utilities		L.E. 25,000
Office Supplies		L.E. 5,000
TOTAL		**L.E. 2,036,000**

As can be seen with this budget is approximately the amount recommended of 34 L.E. per feddan. Therefore, the budgeting process for the Directorate appears acceptable for supporting the district.

Recommendations

The primary obstacle to effective water utilization in Egypt at the district level is the lack of equipment and materials for improving the system of district canals. There are sufficient personnel numbers, although there is a shortage of qualified technical staff in each district to perform the required functions but there are no equipment or materials even for painting the offices. The district responsibilities are divided between the Irrigation, Drainage, and the Mechanical Electrical Departments. There is no formal organization for the different entities to communicate or work together even though in many instances coordination is satisfactory. Because there are three distinct organizations, with identical administrative organizations there is much redundancy and wasted effort with individual organizations. Many of the staff are under utilized because there are no materials for them to improve so that they can perform their jobs.

An Integrated Water Management District (IWMD) should be formed with ministry policies sufficient to provide the authority to manage all the water resources of the district area. The manager of this IMWD has much greater responsibilities than any of the existing district engineers and his/her position should probably be at the same level as an Inspector. The title of this manager could be "District Water Resources Officer", identifying the fact that he/she is responsible for all of the water resources of the district and that he /she supervises other engineers.

The following are recommendations of items that need to be addressed in organizing the IWMD with the District Water Resources Officer:

Organization

Provide for a delegation of authority to manage the resources of the district.

The officer should delegate authority to his supervisors or supervisory engineers to organize their staff to be most effective for their management. This includes the ability to redistribute positions if necessary and personally train and capacitate individuals under their responsibility.

Each supervisor should be responsible for training the staff in their duties.

Budget

Provide a budget for the officer from existing Directorate funding for operation maintenance and salaries.

Recommend that the investment portion of the budget be used to purchase an excavator, washers, transportation, wagons, ditcher, tools and other equipment required to adequately maintain the facilities

Recommend that the maintenance portion of the budget be used to purchase maintenance materials and contract with private entities as required for maintaining the canals.

Water Distribution/Measurement/Monitoring

Water should be distributed equally among all of the branch canals.

Water should be measured to ensure equitable distribution. Each district should purchase their own measurement set with transportation to measure canals regularly.

Each district should provide for water sample collection for analyzing water qualities, quantities and depths in the canals, drains and groundwater and monitoring quantities withdrawn for irrigation.

Conjunctive Use

Alternative sources of water such as groundwater, drainage reuse and effective precipitation should be used as much as possible to supplement Nile River water. They should be assessed by the IWMD Official and his staff in coordination with higher-level authorities within the Ministry of Water Resources and Irrigation to decide how these resources contribute in meeting a part of the water requirements of the district.

A goal of reusing 1 million cubic meters per 1000 feddans per year should be used in those districts where drainage water is reusable. The reuse pumping plants should all be similar small plants (package plants) that could supplement branch canal water needs. A spare pump should be installed at each plant for operation rotation and for water shortages. Pump usage should be continuous during the branch canal rotation. Excess water supply from the Nile would result in shutting off the pumps. These small pumping plants would best be served by an electrical supply source if possible.

Those districts where groundwater is available should set goals for groundwater utilization by private development of wells. Groundwater should not be considered a district responsibility. Use of groundwater as a continuous supply should be encouraged as much as possible. Groundwater can play a huge role in meeting the municipal and industrial requirements as long as it is protected to produce good water quality. The district should monitor annual use from the groundwater pumps within the district boundaries and ensure groundwater protection.

Canal, Drain, and Equipment Maintenance

Canal and drain maintenance should be by district staff with limited contracting to private companies.

Equipment maintenance should be by district staff that is sufficient to keep the employee busy constantly. Smaller maintenance that cannot be performed by staff should be performed by local mechanics.

A ditcher and several heavy chains should be purchased for cleaning the canal.

Canals should be dredged only as needed to provide design sections. Banks should be trimmed using a ditcher to dress the canal banks and clean out grass.

Washer machines should be used to flush collector drains at least once per year. This work should be transferred to the landowners benefited as soon as possible.

When the washers are not in use, tractors should be used to pull the ditcher and for other construction work on the canals and drains.

One or two construction wagons for the tractors should be purchased to provide material transportation to work sites.

Water Quality

Canals and drains should be cleaned to ensure good flow of water to and away from the farms.

The district should monitor water quality and communicate the results to the residents of the branch canals and drains.

District should be an organizing catalyst in obtaining a fenced solid waste disposal area for each branch canal or community.

The district should encourage some form of sewage treatment for each community by utilizing the threat of violations of the dumping laws. Most small communities could consider a sewage lagoon with a deep anaerobic pit for decomposition of the solid wastes. This would not require excessive area or cost and would not be a public nuisance but would need to be fenced.

Districts should be formulated as much as possible to be responsible for a command area so that water is delivered to the head of a canal by the Directorate and the district is responsible for the area. South Zifta is a district that probably should be expanded to include the head of the two canals that deliver water to the branch canals.

Attachment A

Questions About Irrigation Districts for Port Said IWMD Workshop Groups

ORGANIZATION

- Is it best to combine the maintenance of irrigation and drainage in one section rather than have a separate section for drainage and one for irrigation?
- How many employees would your integrated district really need if they are all effective and are paid sufficient?
- How can we ensure that Drainage and Irrigation maintenance facilities are maintained equally?

LIABILITY

- How can the liability of the engineers be limited for professional decisions regarding their district management responsibility?

MAINTENANCE

- Should the district have the capacity to do some maintenance?
- Will the district have sufficient work (Irrigation & Drainage) to use a contracting company?
- Should the district have maintenance facilities or rely on the directorate or the private sector?

BUDGET

- How can a district budget best be made?
- How can a district budget be controlled and used as a management tool?

SALARIES/EMPLOYEES

- How can employees best be motivated to take pride in the district and their work?
- How can a district pay employees for their value to the district?
- Can the district engineer and supervisors use incentives to increase salaries or provide bonuses for work well done with pride?
- Should engineers receive a housing allowance if they don't use or have district housing?
- How can a district best deal with employees that do not function effectively?

MARKAZ BOARD

- How can a Markaz Board (8-12) best be organized?
- How can a Markaz Board be most effectively used?
- Should the Markaz Board have a say in the incentives of the Markaz Engineer?
- What should be the purpose of a Markaz board?

Attachment B

Suggested Budgets for Discussion by Port Said IWMD Workshop Groups

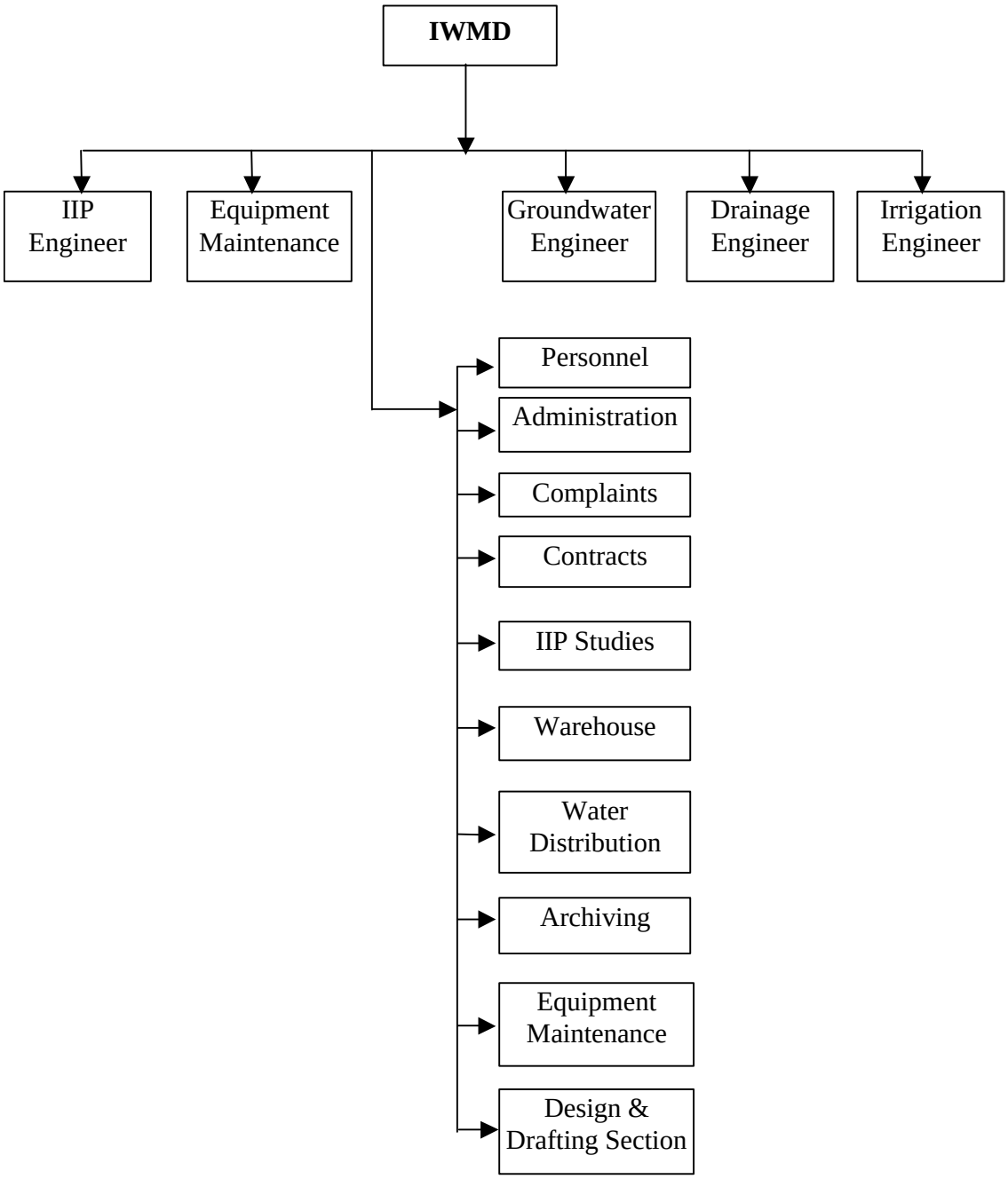
Budget could be L.E. 34 per feddan

	South Zifta	Ibrahimia
Salaries	L.E. 490,000	L.E. 600,000
Supervisors		
Administrative		
Technical		
Water Distribution		
Works		
Equipment and Maintenance		
Health Insurance		
Social Insurance (retirement)		
Equipment (large and small)		
Capitol Investment (new & replacement equip.)	L.E. 200,000	L.E. 300,000
Maintenance	L.E. 100,000	L.E. 200,000
Fuel	L.E. 75,000	L.E. 110,000
Repairs, spare parts	L.E. 50,000	L.E. 75,000
Canal/Drain Maintenance Materials - fill, gates	L.E. 100,000	L.E. 200,000
Maintenance Contracts	L.E. 60,000	L.E. 120,000
Construction Contracts	L.E. 50,000	L.E. 75,000
Building Maintenance & Repairs	L.E. 50,000	L.E. 75,000
Office Utilities	L.E. 20,000	L.E. 25,000
Office Supplies	L.E. 5,000	L.E. 5,000
TOTALS	**L.E. 1,200,000**	**L.E. 1,800,000**

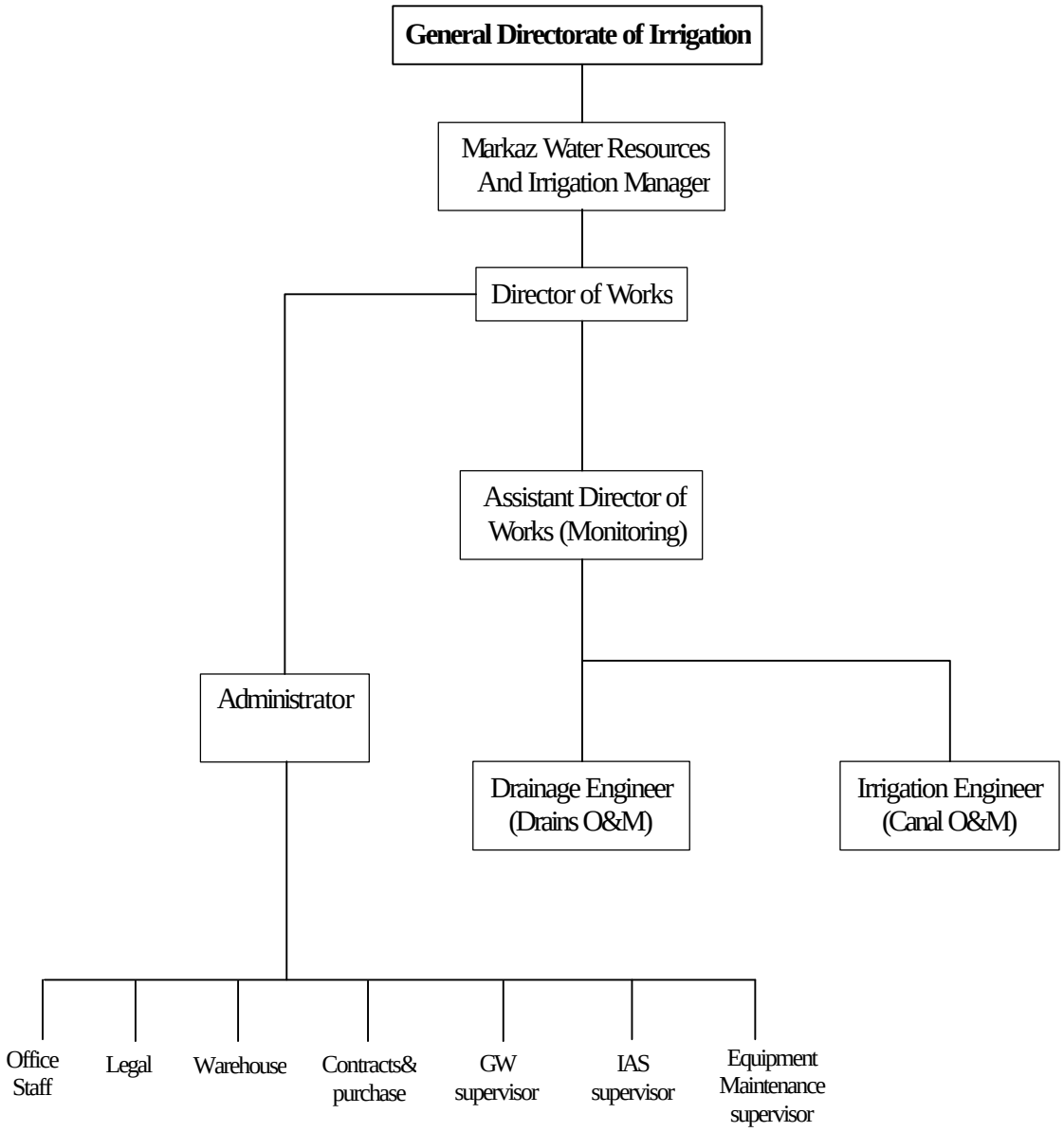
Attachment C

Organizational Charts from Port Said IWMD Workshop Groups

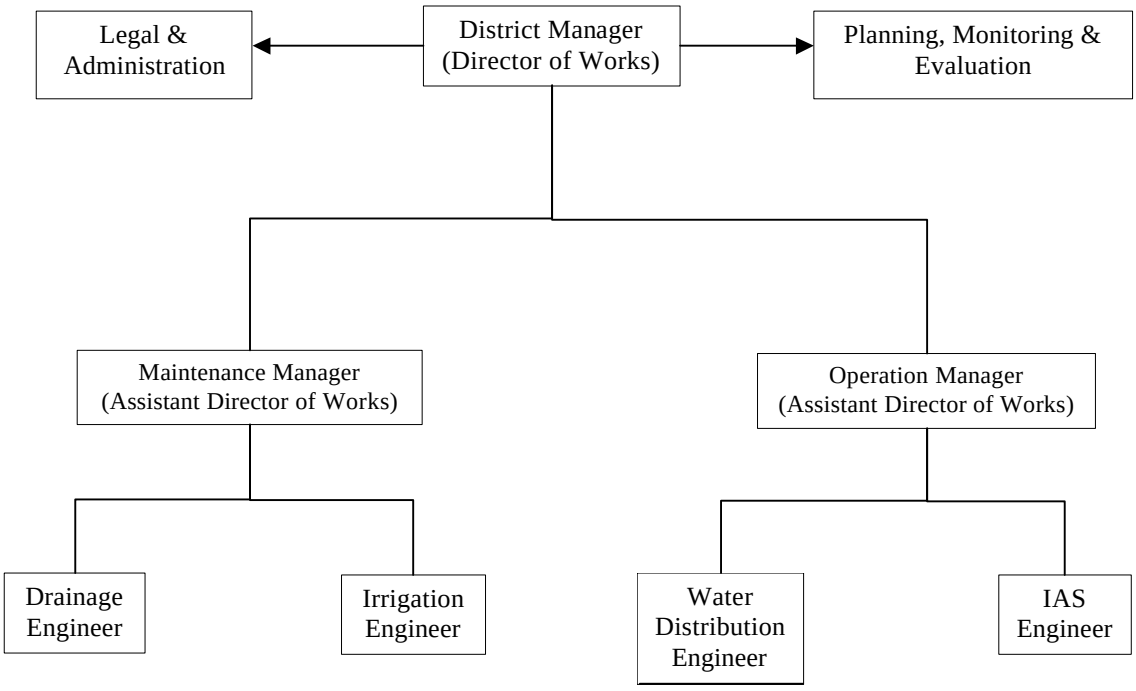
From Group 1:



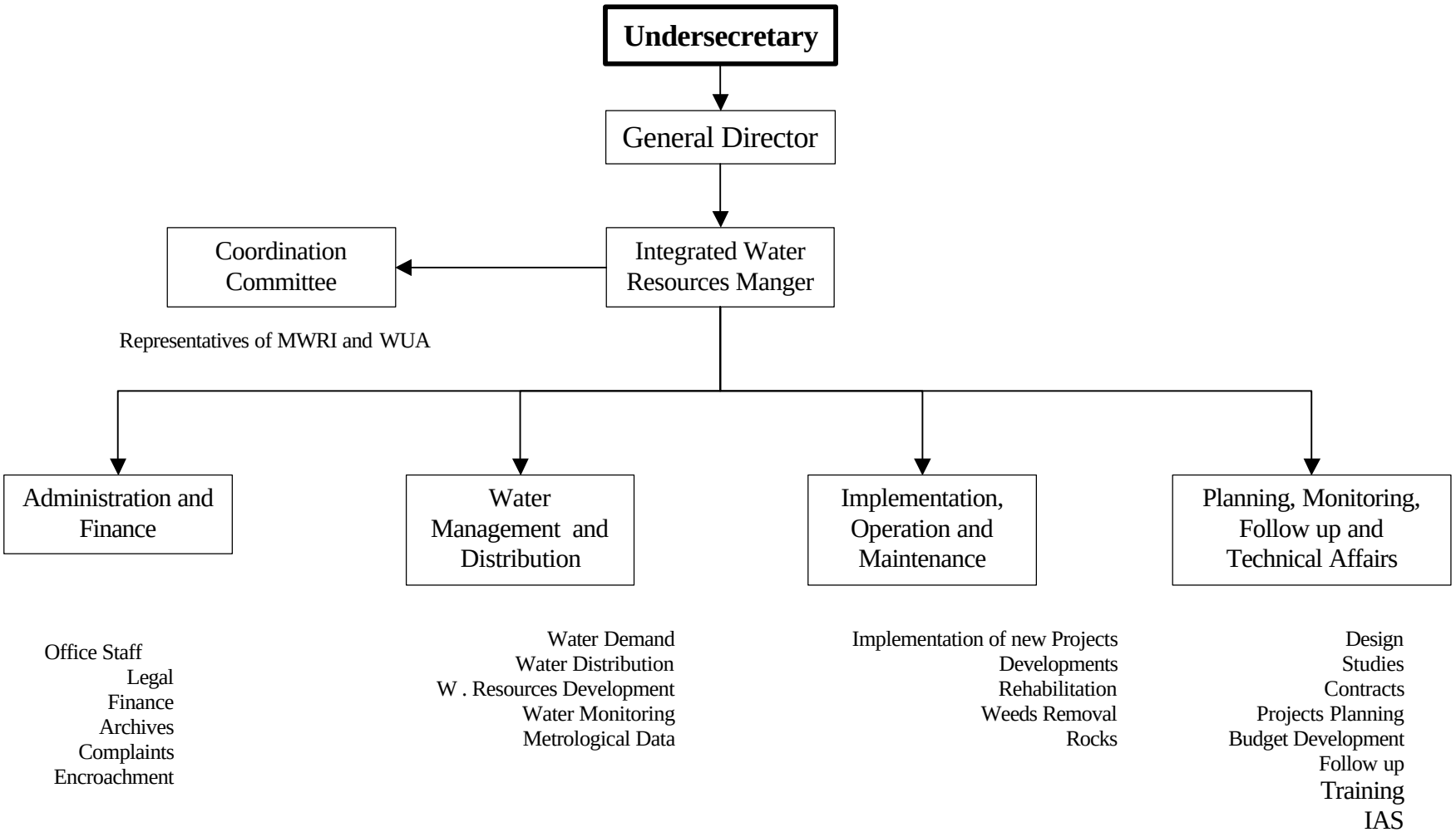
From Group 2:


General Directorate of Irrigation
Markaz Water Resources And Irrigation Manager
Director of Works
Assistant Director of Works (Monitoring)
Administrator
Drainage Engineer (Drains O&M)
Irrigation Engineer (Canal O&M)
Office Staff
Legal
Warehouse
Contracts& purchase
GW supervisor
IAS supervisor
Equipment Maintenance supervisor

From Group 3:


Legal & Administration
District Manager (Director of Works)
Planning, Monitoring & Evaluation
Maintenance Manager (Assistant Director of Works)
Operation Manager (Assistant Director of Works)
Drainage Engineer
Irrigation Engineer
Water Distribution Engineer
IAS Engineer

From Group 4:


Undersecretary
General Director
Coordination Committee
Integrated Water Resources Manger
Representatives of MWRI and WUA
Administration and Finance
Water Management and Distribution
Implementation, Operation and Maintenance
Planning, Monitoring, Follow up and Technical Affairs
Office Staff
Legal
Finance
Archives
Complaints
Encroachment
Water Demand
Water Distribution
W . Resources Development
Water Monitoring
Metrological Data
Implementation of new Projects
Developments
Rehabilitation
Weeds Removal
Rocks
Design
Studies
Contracts
Projects Planning
Budget Development
Follow up
Training
IAS

Attachment D

August 1, 2001

Dr. Larry King and Eng. Sarwat Fahmy
EPIQ Task Managers
USAID Agricultural Policy Reform Program

The report "Function and Organization of an Integrated Water Management District" has been prepared as an evaluation of existing water management in Egypt and methods and procedures possible to implement integration of water management. The integration includes integration of Nile River water use with drain water reuse and groundwater use as well as inclusion of precipitation and water from flash flooding as part of the total water supply. The report reviews environmental considerations that should be weighed as the district is implemented.

The report is an initial analysis of integrated water management districts by using two pilot districts as examples of the potential in budgeting and structuring to allow the district to function effectively but projects a long-term organizational and operational plan. The budgeting process is probably one of the most crucial aspects of the provision of more authority to the districts to manage the water resource. The intermediate steps may not be so clear but should use this report to set forth a potential goal. Page 32 of the report is a proposed organizational chart for the district. This organizational chart is just an example of an organization that could be used. The IWMD workshop conducted at Port Said in July discussed with ministry officials an organizational structure as well as answered questions about the concept of an Integrated Water Management District. The working groups presented three organizational structures and those structures are in Appendix A along with the Questions. All of the proposed structures involve the same responsibilities. The final organization in each district may be completely different but the functions need to be filled.

The IWMD work group needs to evaluate alternatives for phased implementation of the concept and determine phases that could be initiated to accomplish the goal of integrating the utilization of all the water resources of the nation. The following is a suggestion for phasing the implementation of the IWMD:

1. District Engineers empowered with funding.
2. District engineers responsible for training their staff.

3. Combine the three functional districts and their budgets into an IWMD.
4. Implement measurement and integration of all water resources
5. Implement a continuous monitoring program.

The budgets used as the directorate budgets were for the purpose of showing the funding possibility. I am not sure that the budgets are correct and the budget should include the incentives for the salaries also. The individual directorate budgets should be verified.

The districts used as pilot districts were from existing districts as much as possible. However, the organization of the Integrated Water Management Districts should not be so concerned with the existing boundaries as it does with the best management boundaries. The General Director has the authority to change the boundaries based on need. The South Zifta District would be more effective if the command area included all of the three distribution canals (El Sahil Canal, El Khadrawiya Canal, and El Atf Canal) rather than just the north portion of the canals. The Ibrahimia District appears to have all of their distribution canals. There will however, be a requirement for the Ministry to approve the boundary changes.

IWMDs should be formed in all areas where there is water use and irrigation including the oasis and the north coast. All areas with irrigation and water harvesting need some organization to coordinate the management of the resources.

Sincerely,

Dr. Kenneth C. Mitchell
Irrigation District Management Specialist

Activities of Kenneth C. Mitchell
Integrated Irrigation Water Management District
Government of Egypt EPIQ

June 11 Monday Travel

June 12 Tuesday Travel

June 13 Wednesday – Met with Andy Tczap
Greg Olsen – Orientation Safaa set up the computers for me.

June 14 Thursday – Met with Dr. Elassiouti about the organization of the Ministry of Water Resources and Irrigation.
Met with Eng. Mahmoud Gamil about the benchmark potential

June 16 Saturday – Reviewed reports for the different aspects of the project history.

June 17 Sunday - Met with Dr. Wadie Fahim

June 18 Monday – Travel to meet with the South Zifta District and the Minufeya Directorate of Irrigation.

June 19 Tuesday – Met with Robert Cardinalli about Irrigation Management Transfer.
Seminar "Economic Instruments and their Potential Application in Achieving Policy Objectives".

June 20 Wednesday –Met with El Shinawi Economist to discuss the effect of crop budgets and their potential for the farmers to assist in the distribution of water.

June 21 Thursday – Met with the Disrict Engineers of the Zifta and Ibrahimia Irrigation Districts. Also Eng Ali Morsi Head of the Irrigation Department about the concept of the Integrated Water Management Districts.

Met with Eng. Sarwat about the setting up of meetings with the heads of the sectors that the Integrated Water Management Districts would affect or could affect.

June 23 Saturday – Reviewed National Water Policy Report Dated May 2001. Prepared preliminary portion of report concerning Integrated Water Management District

June 24 Sunday – Met with Eng. Hussein Elwan Head of Central Directorate for Water Distribution

Met with Eng. Khayri Shehata – Head of the Nile Sector

MISD working group meeting.

June 25 Monday –Met with Mohamed Morsi Head for the Central Directorate for Canal Maintenance. It is a new responsibility under the ministry that is funded by a Dutch grant to centralize the maintenance of the canals in three directorates so that there can be a comparison of the existing cross sections with the design cross sections. (It would appear that the analysis should also include an analysis of the most efficient cross section.) They also have coordination with Nile Protection Authority to assist with the maintenance of

banks. They do not have in their budget for equipment and it is not a perpetuating project. As soon as the funding is gone the project is gone. They have been using grass carp as the biological weed control of choice for seven years. The grass carp fingerlings cost L.E. 170 per 1000 n(10-20 gms) purchase 22 M fingerlings.

June 26 Tuesday –Met with Eng. Hussein M. Abd El Rahman of the Mechanical Electtrical Department, Eng. Victor Fares Ishak undersecretary projects sector, Eng. Ali Khalil, and Eng. Rifaat Bishara Girgis general manager studies and specs. Their primary function is the design of pumps for new projects and for the operation and maintenance of large pump stations. They design on the basis of 110% of the requested flow for irrigation and 125% of the requested flow for drainage to compensated for wear and inefficiencies of the pump as it ages. They plan for 16 hours of use per day for irrigation stations and 24 hours per day of use for drainage stations.

June 27 Wednesday – travel to Ibrahimia to interview the District Irrigation Engineer and the District Drainage Engineer. Discussed the issues surrounding the formation of an Integrated Water Management District. One of the issues was the liability that the Engineer has now that he is legally liable for deficits or flooding.

The other issue of concern was the number of employees that did not produce. The engineers estimated that 50% of employees did not work besides to enter and then go home at night. They were concerned about housing since the current practice is that the engineer is provided housing. Visited a canal gate and watched the gate operation by the bahari. Visited the development of a well funded by the groundwater section. Looked at potential sites for drainage reuse. Looked at a farmer installation of a well. Viewed the cleaning of a collector drain with their water washer.

June 28 Thursday – Met with the Undersecretary of the Irrigation and Eng. Shalaby of the Irrigation Sector about the potential of reorganization of the districts. The undersecretary for irrigation for Sharkia, Director if Irrigation Zagazig, Director of Drainage Sharkia, Field Coordinator for Water Boards Sharkia to discuss issues regarding the formation of Integrated Water Management Districts.

June 30 Saturday – Prepared trip report for the field trip and reviewed report in the preparation.

July 1 Sunday – Discussed the liability of District Engineers with Dr. Elassiouty. Discussed the modification of Law 12. Reviewed the report on Law 12.

July 2 Monday – Met with Dr Fatma of the GW sector. The organization is 3 central administrations with 8 Directorates with three main goals. Groundwater protection and utilization, Wadi water use and recharge, and conservation of limited supplies. Possibly the areas in the oases need to be addressed for the IWMD. They have no organization on the district level but the district should include a specialist that can address groundwater issues on the district basis and relate that to national priorities.

Met with Eng. Ahmed Mayer former chairman of the Ministry. Discussed the legal aspects of the liability of engineers concerning delegation of authority. Eng Ahmed said that the existing structure has the ministry responsible for protecting engineers in their practice for the ministry. If there was malpractice, the ministry has a committee for disciplinary actions.

He identified that the Director has the authority to handle the budget as is possible as with authorizing the district to budget and be responsible for the entire operation.

July 3 Tuesday – Organizational structure review

July 4 Wednesday – Organizational review

July 5 Thursday - Budgetary work on Zifta

July 7 Saturday – Budgetary work on Ibrahimia

July 8 Sunday – Worked on organizational structure for district

July 9 Monday – Met with Engineer Essam Barakat to discuss the Irrigation Advisory Service status and how they could help in the organization of a model district. Met with Engineer Bazza of UNFAO about scheduling irrigation. Met with Eng Faty of EPADP about the status of the Drainage Authority with respect with an Integrated Water Management District.

July 10 Tuesday – Zifta Met with Eng Azza, Eng Fatma, Eng. Shamir, Eng. Gamil. Visited the delivery point of two canals for the district.

July 11 Wednesday – Shobin el Kom. Met with Eng. Rauf Niskid Kottow Head of water measurement and Eng. Talat el Gamel head of telemetry of the Irrigation Directorate. Then met with Eng.Mohammed, Eng. Amel Abezar and Eng. Rahman of the Drainage Directorate. The reviewed the telemetry system and the measurement capabilities of the directorate with eng. and eng.. Visited the sites of the diversions from the Minufi canal to the South Zifta District.

July 12 Thursday – Tanta Met with Eng Of the Directorate for Water Distribution about water distribution in the Delta. Met with Eng. Fauzi Ibrahim El Sobari, Undersecretary of Irrigation for Gharbia and Eng. Talaat Shehata, General Director for Groundwater for the Delta about the proposed Integrated Water Management District.

July 14 Saturday – Personal

July 15 Sunday –Personal

July 16 Monday – Personal
July 17 Tuesday – Engineer Sarwat, Engineer Gamil, Mr. Andy Tczap, Dr. Larry King, Dr Marshall English, Dr Kenneth Mitchell met to discuss the Workshop for July 18 in Port Said. Discussed the presentation and the division of groups in the workshop. I presented to the group the proposal of the questions and a potential organizational structure for the district.

July 18 Wednesday – Prepared for workshop, traveled to Port Said

July 19 Thursday – Port Said Workshop on Integrated Management Districts

July 20 Friday – Port Said Workshop

July 21 Saturday – Duties at Ministry Prepare report and review the problems of flash floods

July 22, Sunday – Met with Eng. Mohamed Hamid about the translation of the flip charts from the workshop.

July 23 Monday – Prepared more on the report and evaluated the need for solid waste disposal.

July 24 Tuesday – Prepared Report Discussed solid waste disposal with Adrian

July 25 Wednesday – Met with Louise on questions for survey. Worked on report

July 26 Thursday –Evaluate method for recommendations of sewage treatment

July 28 Saturday – Report preparation, editing

July 29 Sunday – Discussed possible interim organization incorporated into report. Prepared presentation handouts for work group meeting.

July 30 Monday – Revised report, met in IWMD work group meeting with Eng. Shalaby, Eng Sarwat, Dr. Ragab, Eng. Mohamed Hamid, Dr King, Dr. Oad, Dr English. Prepared presentation to those that will make presentation of policy changes.

July31 Tuesday – Finalization of report, discussion with Robert Cardinelli on Board of Directors.

August 1 Wednesday –Completion of responsibilities and delivery of report. Debriefing with Dr. Wadie Fahim
August 2 Thursday – Return flight from Cairo to Salt Lake City

Professional Contacts
Irrigation Water Management Districts
Dr. Kenneth C. Mitchell
June 13, 2001 – August 1, 2001

EPIQ

Mr. Andy Tczap
Dr. Ibrahim Elassiouty
Dr. Ragab Abdel Azim
Dr. Larry King
Dr. Robert Cardinalli
Dr. Marshall English
Dr. Ramchand Oad

WPAU

Eng. Mahmoud Gamil
Eng. Sarwat Fahmy
Eng. Mohamed Hamid
Eng. Monem El-Sharkawy

USAID

Dr. Wadie Fahim

MWRI

Eng. Ali Morsi	Head, Irrigation Department
Eng. Mohamed Fathi	Head, EPADP
Mr. El Shinawi	Economist, IIP
Eng. Hussein Elwan	Head Central Directorate for Water Distribution
Eng. Khayri Shehata	Head Nile Protection Sector
Eng. Mohamed Morsi	Head, Central Directorate for Canal Maintenance
Eng. Hussein M. Abd El-Rahmaan	Head, Mechanical & Electrical Department
Eng. Victor Fares Ishak	Undersec., Projects Sector Mechanical Electrical Dept.
Eng. Ali Khalil	Studies and Specs, Mechanical Electrical Dept.
Eng. Rifaat Beshara Girgis	General Manager, Studies and Specs, ME
Eng. Mohamed Elwarraki	Undersecretary Irrigation, Sharkia
Eng. Abdel Monem Shalaby	Head, Irrigation Sector
Eng. Yehia Abdel Aziz	Water Boards, Cairo
Eng. Abdel Rehim Nasr	General Director of Irrigation West Sharkia
Eng. Ghoneim Abdel Meguid	General Director of Drainage, West Sharkia
Dr. Khalid Wassif	Field Coordinator, Water Boards Sharkia
Eng Abdel Latif Said	Irrigation Inspector, Zagazig Inspectorate
Eng. Abdel Fattah Elbaz	District Irrigation Engineer, Ibrahimia
Eng. Ibrahim Ezzat	Director of Drainage Works, South Sharkia
Dr. Fatma Abd el Rahmen	Head, Groundwater Sector
Eng. Ahmed Mayer	Former Chairman of Irrigation Department

Eng. Essam Barakat	Head Irrigation Advisory Section
Engineer Bazza	United Nations FAO Crop Water Scheduling
Eng. Mohamed Shamir	Inspector Zifta Inspectorate
Eng Azza Abdel Hamid	District Irrigation Engineer South Zifta
Eng, Fatma Abdel Aziz	District Drainage Engineer South Zifta
Eng. Gamil Gergis	Director of Works Zifta Inspectorate
Eng. Abdel Hamid Elgayyar	General Director Irrigation Minufeya
Eng. Raul Niskid Kottow	Head, Water measurement, Minufeya
Eng. Talat el Gamal	Head, Telemetry, Minufeya
Eng. M. Abdel Kawy Seliem	General Director Drainage Minufeya
Eng. Amel Abezar	Director of Drainage Works, Minufeya
Eng. Rahmanof	Director of Drainage Works, Minufeya
Eng. Abdel Meguid El Adalany	Undersecretary Irrigation Minufeya
Eng. Fauzi Ibrahim El Sobari	Undersecretary, Gharbia
Eng. Talaat Shehata	General Director Groundwater Middle Delta
Eng. Abdel Rahman Shalaby	Consultant

Attachment E

Pictures of Ditcher

(See Maintenance, Page E-32)